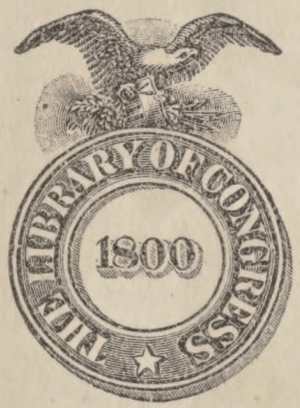

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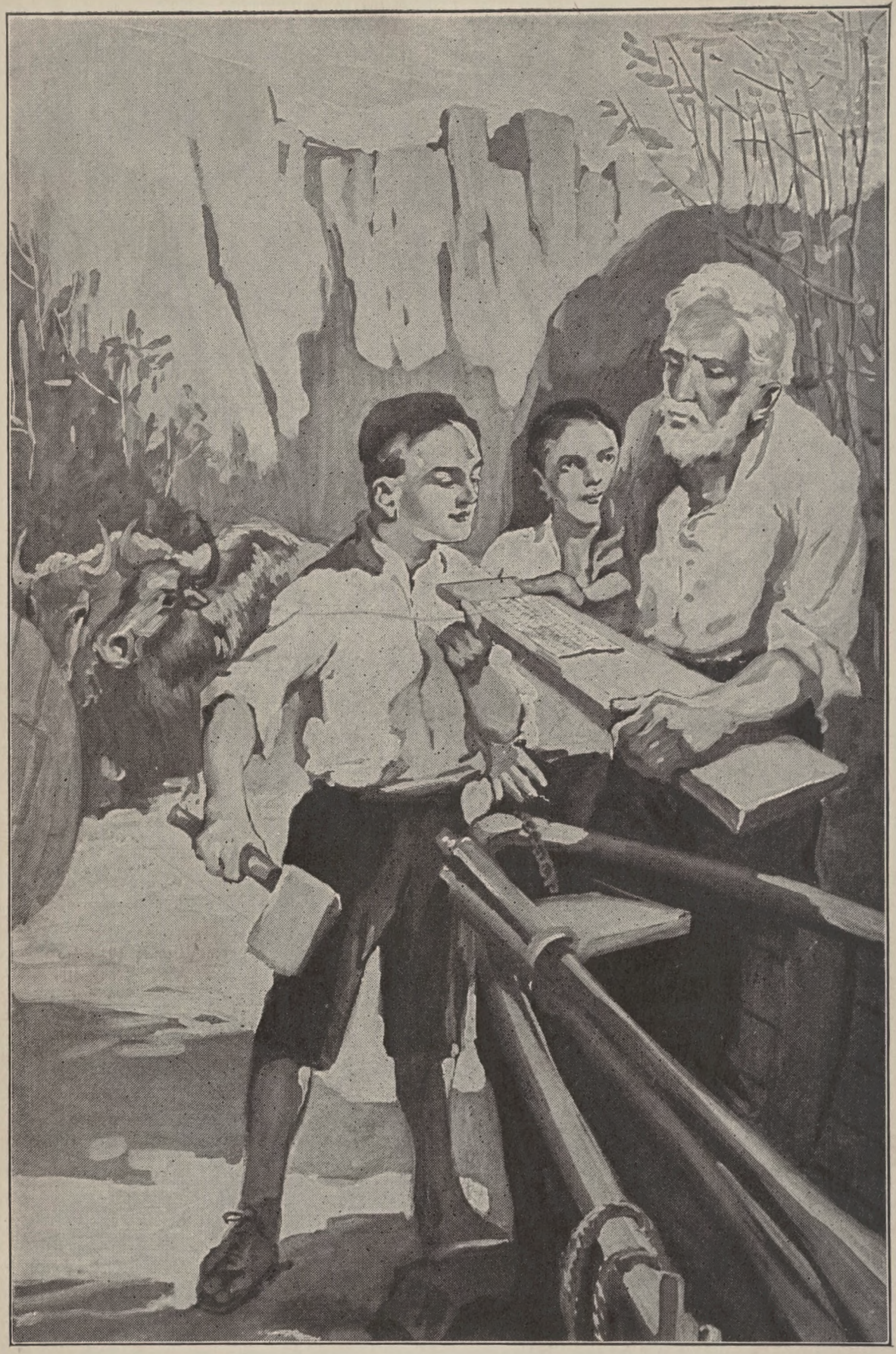

"The professor was reading the scrap, and silently handed it to George"

[See p. 43]

THE WONDER ISLAND BOYS

THE MYSTERIES OF THE CAVERNS

BY

ROGER T. FINLAY

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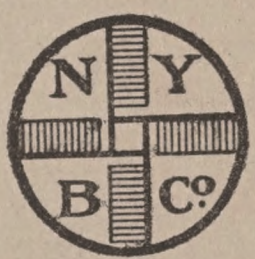

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THE MYSTERIES OF THE CAVERNS

CHAPTER I

MYSTERIOUS DISAPPEARANCE OF THE TEAM

The boys looked at the Professor in amazement. They were too much excited and concerned at the new situation to be able to interpret what the sudden disappearance of their team meant.

The Professor turned to the boys: "Are you sure the yaks were tied before we left them?"

"I was particularly careful," answered Harry, "to tie both of them."

"I am pretty sure that both were securely fastened, and they were in that condition when I came back the last time," was George's reply.

To understand the peculiar situation above referred to, it will be necessary to go back and briefly relate some of the remarkable events which had taken place in the lives of the three people concerned in this history.

George Mayfield and Harry Crandall, together with a Professor, were mates on a ship training school, which sailed from New York one year before. A terrific explosion at sea cast them adrift in mid-Pacific Ocean, and after five days of suffering they were cast ashore on an apparently uncharted island, without any food, and entirely devoid of any tools, implements or weapons.

Exercising the knowledge of the Professor, and the ingenuity of the boys, they gradually dug from mother earth and from the rocks and trees the articles necessary to sustain life, and eventually they found different ores from which various implements and weapons were made. They constructed numerous machines, crude, at first, and gradually developed them. They succeeded in capturing yaks, a bovine species of animals, some of which were trained like oxen; wagons were built; a shop constructed; a water wheel installed; a primitive sawmill put up; a primary battery made; articles of clothing woven; felt made; and numerous things of this character originated from material which nature had furnished in its crude state.

While doing all this the desire to explore the island was a predominating one. Four trips into the interior had been made in order to ascertain whether or not it contained any human beings. During those trips numerous evidences were found to show that savages were there, and some indications that civilized people had visited the island.

The peculiar happenings which excited their interest were the mysterious things that occurred at various times, among which the following may be briefly enumerated: The disappearance of a boat, which they built, and which was left at the place where the team was lost; the subsequent finding of the boat among debris on the seashore, having oars and rope in it which were strange to them; the removal of the flagpole and flag

which had been erected up on a high point near the ocean, called Observation Hill, and the fire in the forest.

To the foregoing may be added the discovery of a prospecting hole, which had been dug, evidently, by some one in the hope of finding mineral; a yak with a brand on it; wreckage of a boat, which, undoubtedly, belonged to their ill-fated ship; a gruesome skeleton on the seashore; and finally one of the lifeboats of the schoolship and a companion to their own, found on the shore of the stream where they now were.

All these things were sufficient not only to cause alarm, but the greatest consternation on the part of the boys. It must be said, however, that the trials of the boys, under the calm, calculating deportment of the Professor, had done much to make them self-reliant. George, the elder, was of an exceedingly inquisitive turn of mind; he was a theorist, and tried to find out the reason for everything. On the other hand, Harry was practical in all his efforts; he could take the knowledge obtained and profit by it, as the previous volumes show. It was fortunate, therefore, as the Professor put it, that theory and practice were personified in the two boys, who, although companionable, were the exact opposites as types.

The Professor never showed a preference, in any manner, for either. Like the true philosopher he saw the value of the two distinct qualities, the one useless without the other.

When they had fully recovered from their as-

tonishment, George was the first to speak. "They may have broken the fastenings."

The Professor, who had been intently examining the tree to which they were hitched, said: "I can find no evidence of any undue wrench which might show that they had gotten away by their own exertions. Let us see whether we can follow the trail."

The ground was covered with leaves, so that no earth was visible, and the only sort of trail left in a forest, under those conditions, is the slightly depressed tracks which the wheels make. They examined this, noting also the overturned leaves, which are usually left in the wake of cattle.

The latter means seemed to be the only available way in which any trace could be made out, and this they followed. It led directly to the west, and toward the section they were desirous of exploring at the time the present trip was inaugurated.

"How fast do you suppose the team is traveling?"

"Certainly not faster than we are now going. They cannot be hurried very well, as you know, and we should be able to overtake them within an hour or two."

"But what shall we do if we find them in charge of somebody?"

That suggestion brought up at once a very serious question. They had made six pistols, very crude, it is true, but which served admirably as weapons of defense; but the hazardous part of the present situation was that only the Professor

had one of the pistols, the others having been left with the team. The only thing which added some comfort was the knowledge that as the pistols required a special hook to enable them to cock the firing plug, and as the Professor had this hook, those who took the team might not be able to use the weapons against them.

At this place it might be well to refer to Red Angel. Nearly nine months before, on one of their trips, a baby orang-outan had been captured, and the boys educated him, as best they could, and he really developed many reasonable instincts. It was Red Angel who left the wagon and followed them down the river, and who by his peculiar actions attracted attention to their missing team.

"We owe something to Angel for his cuteness in coming for us," said Harry.

The orang progressed rapidly, swinging, as he did, from tree to tree on the route, and when no trees were in sight, would shamble along in a peculiar way, as it is difficult for them to walk erect. Their feet are not adapted to promote a graceful gait.

"The track seems to be lost," said the Professor. "I cannot make it out, either from the leaves or the depression. However, it appears best to follow this course."

Without stopping they proceeded in the same general direction. Red Angel, who up to this time had followed the route taken by the party, now turned to the right, and when George called, refused to return. As George walked toward him,

he kept advancing to the right, and could not be induced to come back.

"Probably we should follow him," was the Professor's conclusion.

It was evident from Angel's antics that the change in the course delighted him.

George, who was ahead, soon stopped, and shouted back, gleefully. "Here are the tracks! Good fellow, come here!"

Angel understood this. He had actually sensed the direction taken by the missing team, for here were the tracks. The only thing that grieved George was the absence of the honey pot. Angel's weakness was honey, and that was now with the team.

Suddenly Angel, who was now in one of the large trees which grew all along the course, began an excitable chatter, and vigorously jumped from one limb to the next, and George, who knew his antics pretty well by this time, stopped and prepared himself for some new and unexpected development in this remarkable journey. Angel, on the other hand, started off through the trees with wonderful agility, and it was all the boys could do to follow.

There, ahead of them, was the wagon perched against a tree, one of the front wheels and an axle broken, and the tongue wrenched off; but the yaks had disappeared. It is singular that the team had gone thus far without meeting an obstruction. As it was, one wheel had locked with a tree, and the yaks, by their tremendous power, had broken the parts mentioned and gone on.

Before the wagon was reached, however, numbers of articles were found scattered along the trail, which were gathered up.

The finding of the wagon was an intense relief. Their minds had been perturbed with this occurrence, as never before, and they had met numerous thrilling episodes before.

"Something must have frightened the yaks, and they were going at a much greater speed than at a walk when they collided with the tree," observed the Professor.

"Why do you think so?" asked Harry.

"In the first place, the fact that our articles were scattered along the path before they reached the tree; and, secondly, the wagon pole and the wheel were strong enough to hold the yaks against the tree if they had been moving along at their usual gait."

"Well, I am thankful that we have the wagon, even though the yaks are gone," said George, as he crawled into it. He peered out and continued in a surprised tone: "Where do you suppose the pistols are? Did you leave yours in the box, Harry?"

"Yes; on the right side. Yours were there at the time. I saw all of them."

"They are not here now, and it is likely they have been lost with some of the other things." Harry was up in an instant.

"Where is the ammunition?"

"It was all in the bottom of the box."

It did not seem at all likely that the pistols or the ammunition could fall out of the box. It is

true other things had fallen along the way, but this seemed to be such an unlikely occurrence that they could scarcely credit it.

The provisions were safe, and you may be sure that Angel was not only petted, but he received a good share of the delicious sweet.

It was now nearing night, and they were fully ten miles from home. Ten miles is not a long tramp, but to travelers like ours, already weary with their trudging and with the excitements of the day, it was concluded to camp in the wagon for the night, and then proceed home early in the morning. To take the wagon would be an impossibility.

They really learned to love the patient yaks. For fully five months they had been daily companions, and were now so well trained that some discouragement was felt at being compelled again to break in others. They had an ample supply of good material in the herd to pick from, but it took time and patience to develop such a team as had been lost.

During the entire night one of the trio kept watch, not so much from a feeling of fear as in the hope the yaks would return during the night; but they were doomed to disappointment. Morning came, but the yaks did not, and after gathering together the most useful belongings, and putting them into convenient bundles for carrying purposes, set out for home.

The first question taken up by the boys after their return was the selection of a pair of young steers for the new team; and the work of making

a new pair of yokes was carried forward with energy. They were in the midst of the planting season which had been interrupted when the last journey was undertaken.

Hitherto it had been the custom to devote at least one day each week to hunting, on which occasions they also made trips to such points in the island as had not been previously visited; and it was also a part of their duty to examine the woods and the fields to find new specimens of plants, fruits and flowers; and among the hills and ravines were many kinds of ore, some of which they had been fortunate enough to find on their entry to the island.

The metals thus found were utilized, because they had set up a workshop alongside the sawmill, and in it had a crude lathe adapted to work in wood or iron. It will thus be seen that each tour was for prospecting purposes, to supply their needs, as well as to learn what the island contained.

Each evening it was the habit to have a general discussion concerning the events of the day, or with reference to matters of moment about the work to be done on the morrow.

George was much interested in the planting program. "What kinds of vegetable would it be most advisable to plant in the space we have prepared?"

"One of the important points to consider in the planting of all crops is whether the soil is adapted for it. When the United States were first settled it was a surprising thing that many of the original

settlers would go miles inland, exposed to every sort of danger, to find land, when there was plenty nearer the seashore or close to civilization. There was a reason for that which we are only now beginning fully to understand. Plants have a habit of growing in soil adapted for their needs, and it would be an interesting study in going over our island to consider the habits of plants in this respect."

"Is that the reason why different countries have such different kinds of plants?"

"Yes; plants select their soil, and owing to these habits, every variety of soil, in every climate, supports its own vegetable tribes. Of the five thousand flowering plants of central Europe, only three hundred grow on peaty soils, and those are mainly rushes and sedges. In the native forests of northern Europe and America, the unlettered explorer hails with joy the broad-leaved trees glittering in the sun among the pines, as a symptom of good land, which he knows how to cultivate. The rudest peasant in Europe knows that wheat and beans seek clay soils; the northern German knows that rye alone and the potato are best adapted for the blowing sands of that country; the Chinese peasant, that the warm sloping banks of light land are fitted for the tea plant, and stiff, wet, impervious flooded clays for his rice. Even the slaves in the Southern States were aware that open alluvial lands were best suited to cotton; and the degraded slaves of Pernambuco know that the cocoa grows only on the sandy soils of the coast, just the same as in west Africa the oil palms flour-

ish on the moist sea sand that skirts the shore, and the mangroves where muddy shallows are daily deserted by the retiring tide."

"Some time ago you stated in one of our talks that soil was the necessary thing to select in order to propagate, or make good fruit and grain out of the poor or wild kind. Were all our vegetables and grains originally wild?"

"Originally nothing in the way of fruit, flower, grain or garden vegetables was anything but wild and unproductive, or bitter, tasteless or unprofitable. Chemical changes are made in the plant by the soil in which it grows, because it is from the soil that it gets its food. The large and juicy carrot found at home is nothing but the woody spindle of the wild carrot, and I have found several species of it here. Cabbages, cauliflowers, Brussels sprouts and a host of other like vegetables were, in their natural state, poor, woody, bitter stems, and had useless roots. As I have already stated, the wild potato, which we are now cultivating, has, in its original state, a bitter root, as you have discovered."

CHAPTER II

WORKING ON THE NEW BOAT

Early the following morning Harry sprang out of bed and hurriedly shouted: "What did we do with the lifeboat in South River? Do you remember whether we secured it when Angel came up and let us know about the team?"

The Professor and George were up in an instant. George was the first to answer. "I left it the moment Angel came up."

"I cannot remember," said the Professor, slowly, "but it seems to me, now that I think of it, we left it on the banks, and it wouldn't do to leave it there. You must go for it at once, and bring it down to the bay, even though you cannot bring it around the cliffs."

A hurried breakfast was prepared and the boys started off at an eager pace for the river. They went directly southwest, aiming to strike the river near the falls, and after passing over familiar ground, came within several miles of it, when, in going down one of the sloping descents, saw, in the distance, what appeared to be portion of the yoke which the yaks carried.

They hurried forward, and great was the delight at finding it was really one of those they had made and used for months. It was a gratification to know that the animals were east of the falls, and, probably, sooner or later, would turn up at their

home. Only one of the yokes was found, but there was evidence that both of the yaks were freed, since the part of the other yoke was still attached to the part found.

The boys were glad of this, as they had such a friendly feeling for the animals that they could not but feel that to be yoked together in the forest would be a cruelty to them.

"The Professor will be glad to know this," said George. "Look at this part of the yoke, where it has been broken. I have no doubt that this is

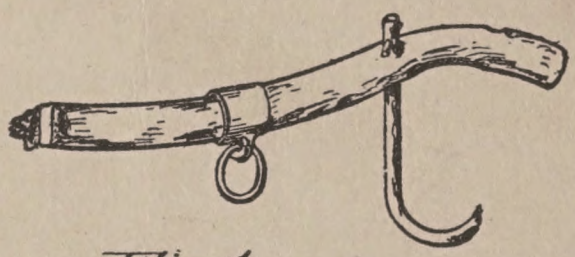


Fig. 1

THE BROKEN YOKE

where they struck the tree where the wagon caught."

"Let us take it with us, by all means," said Harry. An examination of the yoke plainly showed where it had come in contact with bark with considerable force. "What do you suppose caused them to be so frightened as to run away?"

They quickened their steps, and soon reached the river. There, on the shore, was the lifeboat, as they had left it, and it was the work of minutes only to set it adrift, and after depositing the yoke in the bottom, the first task was to supply themselves with a pair of oars.

The first article turned out in the way of tools

was a bolo, a heavy cleaver-like blade, used by many primitive tribes. This article was duplicated by them, and always carried on all their expeditions. With this several small trees were cut down, and a pair of oars fashioned for each, and within an hour they were on their way down the stream, and in two hours more had rounded the point of projecting land east of the river mouth.

"Don't let us take any more chances of losing this boat. I am in favor of taking it around, and am willing to risk the tide, whatever it may be."

Harry's suggestion met with favor on the part of George, and when the point was rounded and they were out in the ocean, the tide, although coming in, had no terrors for them, but they boldly plied the oars, and before four o'clock had rounded the cliff point, and steered the craft into the mouth of Cataract River.

The Cataract was a much smaller stream than South River, and it was on the northern side of the island; whereas South River was on the southerly side of the island. Less than a quarter of a mile from the open sea was a cataract, at which their home was located, and the cataract was utilized as the means for producing water power.

Their appearance below the Cataract was hailed with delight by the Professor, and you may be sure that when the boat was finally landed and hauled up on the beach, all of them joined in the congratulations, which was their due.

"Just to think of it. If we had the boat we made, our lifeboat and all the parts of the wreck of the other boat, we would have a pretty respectable navy," was Harry's observation, when they

landed. As it was, they now had the wrecked after part of their own lifeboat, and here was the other lying alongside. They knew the history of one of them. Would they soon know why the other should have been found in the interior of the island under such peculiar circumstances?

"And where did you get the yoke?" asked the Professor, as his eye caught sight of it.

"Two miles this side of the falls."

They little knew at this time what an important bearing the finding of this boat would have on their future course, nor could they know how this little incident would be of the greatest value to some of their companions on the ill-fated ship.

They now had possession of a boat which, while it was practically unsinkable, was not of such size as to meet their demands for the intended explorations. They felt that to attempt to circumnavigate the island and take all the chances which a meeting with natives might involve, would necessitate a much larger vessel. To add to the difficulty, all the pistols but one had been lost in the last trip, and to attempt to make explorations without proper weapons would be foolhardy. If they knew one thing, with any degree of certainty, it was that the island contained savages of some description, and provision must be made for every contingency.

Harry took upon himself the task of turning out more of the weapons, and with the experience of the past four months in this line of work, concluded he would attempt a better job than simply making pistols. It was his ambition to make a firearm that would enable them to bag the largest

game, and also, at the same time, carry the bullets a greater distance than the short eight-inch barrels could.

To do this it was necessary to provide longer bits, and as the design of the new guns contemplated a barrel at least eighteen inches long, the bits had to be longer, in proportion, and the making of these consumed nearly as much time as the actual drilling out of the barrels.

George and the Professor put in a great deal of time with the new team. Their knowledge of training, in view of the former experience with these animals, was such that within a week they could drive the yaks without much difficulty, although the new team was not by any manner of means as efficient as the lost one.

When the question of the kind of material for the guns came up, Harry was much concerned, as in making the barrels that length would necessarily greatly increase the weight.

"I think it would be better to make an alloy for your purposes," said the Professor, as they were discussing the matter.

"What is an alloy?"

"It is the combination of two or more metals."

"In what way does the alloy make it better than the hardest steel?"

"It is not hardness you want, but toughness. Metals have several properties, which are utilized for various purposes in the arts. Surprising as it may seem, wood has greater resisting power than diamond, and yet the precious stone is the hardest of all substances."

"But if we unite two metals are we not then making a new metal?"

"Not necessarily so. In the case of brass it is true. This is made by uniting two parts of copper and one of zinc. Both copper and zinc in themselves are very soft, and copper cannot well be polished in its pure state. Brass, however, is not only much harder, but is susceptible of a very fine polish."

"Are the alloys of all metals harder than the metals of which they are made?"

"This seems to be a universal law in the compounding of metals. Very few metals are used alone in the various arts and manufactures. For every purpose some combination has been found which makes the product better. Even coins are so alloyed. Silver and gold in the form of money would be entirely too soft, unless alloyed with some hardening metal. Some substances, like arsenic, antimony and bismuth, are too brittle to be used alone. The only metals which can be used alone are aluminum, zinc, iron, tin, copper, lead, mercury, silver, gold and platinum."

"What is bronze, of which all the ancient guns were made?"

"That is a combination of copper and tin. This product was known fully seven hundred years before the Christian era, and was used in the making of guns until superseded by the various steel alloys of our day."

"In what proportions are copper and tin united to make bronze?"

"The proportions vary greatly. Ancient Celtic

bronze had 12 parts tin and 88 of copper; Egyptian, 22 tin, 78 copper; Chinese, 20 tin, 80 copper; Roman, 15 tin, 85 copper; and in many specimens lead and zinc were also used. Tin has a capacity to harden almost any metal."

"What is the best metal to harden steel?"

"Manganese, of which you will remember we have some samples; it is the most serviceable, as we have neither nickel nor chromium."

"What amount of that metal should we use to get the best results?"

"About 14 per cent. of manganese has been found the best for such purposes as would be required in gun barrels. There is a curious thing which has been discovered in uniting manganese with steel. It becomes fairly tough if 1 per cent. is used with the steel; if the quantity added is between $1\frac{1}{4}$ and $3\frac{1}{2}$ the strength and ductility decrease; but above that, up to 5 per cent., the steel becomes brittle; above $6\frac{1}{2}$ per cent. it again returns to ductility and toughness and its maximum strength is found at 14 per cent."

During the evenings all took a hand at cutting out the stocks for the guns, and the plans upon which they were constructed will be fully explained and illustrated in the order of the work done.

Meanwhile it must not be supposed that work on the new boat had ceased. Harry's plan, when fully worked out, provided for one twenty feet long and six and a half feet wide amidships.

The drawing (Fig. 2) shows the construction of the hull. As they had no means for doing any fancy bending of the boards, the bottom was made flat, and the sides sloping. The bottom and the

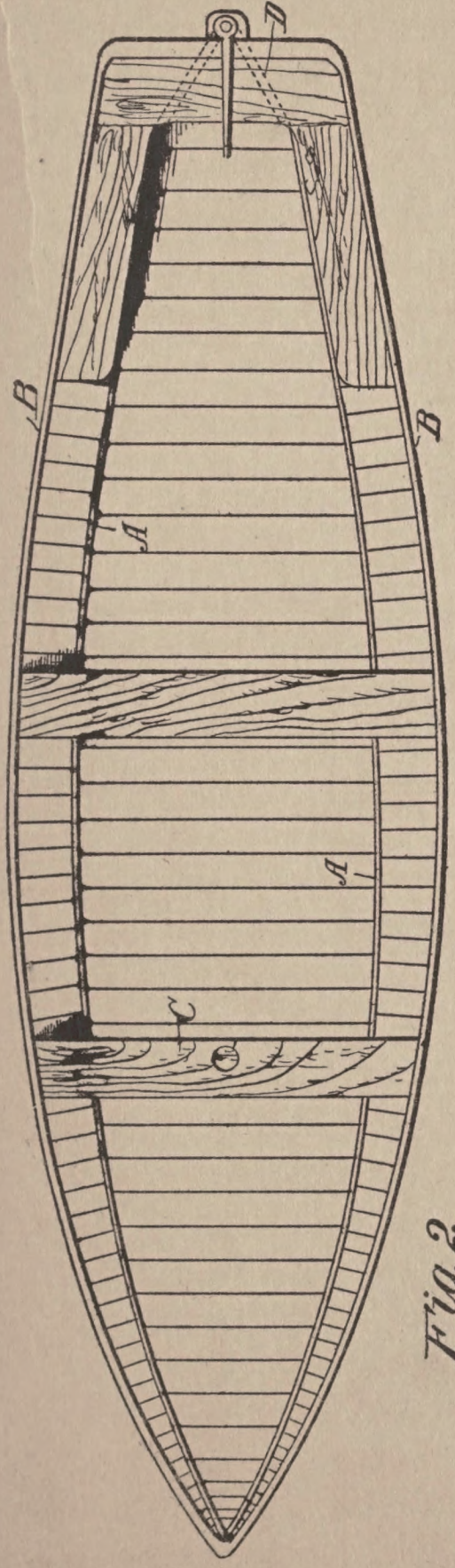


Fig. 2.

Side View.

Fig. 3.

sides were made in the following manner: Two stringers (A, A) were first constructed, which were made up of thin pieces nailed together, so they could be bent in the proper shape for the bottom boards, which were laid crosswise and nailed to these stringers.

For the upper edges of the sides, called the gunwale (B, B), similar stringers were provided, but they extended farther fore and aft, and amidships were fully six and a half feet apart, whereas the lower stringers amidships were four and a half feet apart. This arrangement, therefore, provided for sloping sides, and the side pieces ran up and down on the inner course. It will be understood that the sides and bottom thus formed were to be overlaid with thin boards running fore and aft, as in Fig. 2, as they had no means for matching the boards and thus putting them together tightly.

The sides were two and a half feet high. Six and a half feet from the forward end was a cross beam (C), into which the mast was to be stepped. At the stern the bottom was sloping upwardly at an angle and brackets (D) were extended back and joined at their rear ends, to which the lower end of the rudder post was attached.

Amidships a keel (E) was formed, projecting down from the bottom, this keel being, at its widest part, two feet, and tapering down to merge with the bottom, fore and aft. The cross section (Fig. 3) shows how well he had formed the vessel, proportionally.

In addition to the cross seats, similar arrangements for comfort were made along the sides, and

beneath the side seats were spaces in which their supplies were to be placed. The space forward of the mast was entirely closed over with a roof which sloped in both directions, and here provision was made for two berths. This would also afford them protection and serve as a means to keep out the water and insure at least one dry spot for their comfort.

As usual, George had some inquiries to make about the boat. "It has always been a matter of

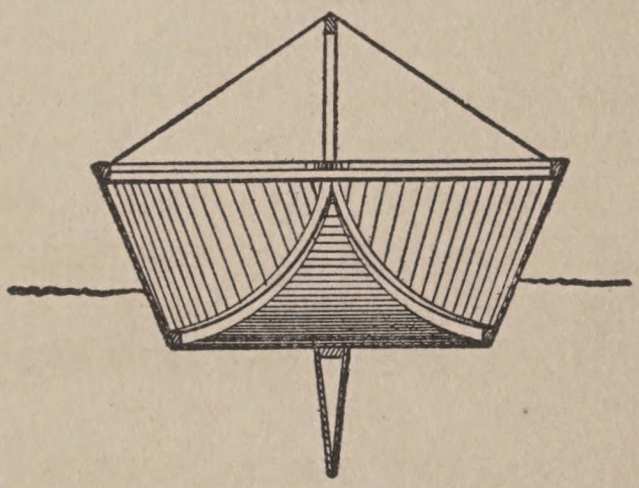


Fig. 4. Cross Section.

wonder why all boats are made with the big bulging part nearest the forward end?"

The Professor's eyes twinkled. "Probably there are a great many others who have had such thoughts. There is really no reason for it. It is not known how the custom originated, except that in sailing vessels the claim is that the ship can be maneuvered more easily by such construction."

"In what way does it make it easier to handle?"

"When a ship is driven forward by the wind, all the force exerted on the sails is transferred to the forward part of the ship, hence if made narrow

at its forward end it would be driven down into the water, and the hull would, therefore, be submerged more at the forward than at the rear end. Furthermore, by having a tapering rear end, the rudder has a better opportunity of veering the ship around and you can see that the bulging part, being located forward of the middle portion of the ship, acts as a sort of pivot."

"But it seems to me that none of the reasons given will apply to a steamship, and still all the ships I have seen are made in the same way as the sailing vessels."

"That is exactly what I inferred in my answer to your first question. The truth is, that in experiments which have been made, it is shown that to have the widest part of a steamer near the stern, gives lines to a hull which has less resistance than if made in the conventional way."

"I thought probably the reason for making them so was just the same as in the case of an arrow, where the heaviest part is at the forward end."

"In that case an entirely different principle is involved. A body falls, or is projected through the air, with its heaviest end foremost, because of the greater momentum in that portion."

"It is the force of a body in motion. When a body is projected through the air it meets with the resistance of the atmosphere, and this also serves to turn the heavy side around to the forward end, because the force of momentum in the heavy end is much less affected by the resistance of the air than the lighter end." (See Fig. 5.)

Red Angel had now been with them more than six months, and he was probably a year old.

When first captured he was a scrawny infant, dull and stupid, like all of his class. He had wonderful powers in the way of imitating habits and customs. The boys were very good vocalists, and while at work Harry would sing, but George whistled. It was an amusing sight to watch Red Angel when the boys engaged in the frequent concerts at night.

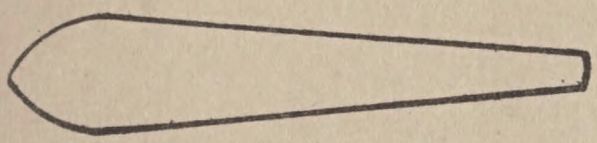


Fig. 5.

Fig. 6. Red Angel.

But of all the screamingly funny exhibitions, the attempt of Angel to imitate whistling was the most ludicrous. The orang's lips project too much to a point, and the jaws are so narrowed that the lips will not pucker. Whenever the boys commenced their concert Angel would be on hand, and enjoyed every moment of the time, and the boys had many a concert purely for his benefit.

At the end of each concert the whistling would begin. This invariably brought Angel to the front, and his exhibitions would be given with the utmost gravity and earnestness. The invariable result would be such uproarious fits of laughter on the part of all that he would take part in the jollification, little suspecting that the laughter was at his expense.

The only sound which he could emit during these

performances sounded like a high-pitched stick rattling along a pale fence; but he was inordinately proud of it. It had always been on one key, heretofore, and without variation; but this evening Angel startled himself, as he did the others, by actually sounding two additional notes. He repeated this over and over.

"I wonder if we could make him talk?" asked George, after the laughter had subsided.

"There is no reason why some tones cannot be imitated. As the orang possesses wonderful powers of imitation and has, in captivity, developed many traits, I see no reason why simple words, or sounds, cannot be taught."

"I know there are words which he does understand. Time and again I have told him things, which he seems to understand. Now see if he understands this: 'Angel, do you want some honey?' "

His attempts at whistling ceased, and in a moment more was in the kitchen. Harry, who by this time had recovered from his mirth, thought it would be a good idea to attempt to teach him.

"If canary birds and dogs can understand language, I do not see why Angel shouldn't."

"Unquestionably, any animal, by patience, will learn the meaning of sounds. Constant repetition of certain notes causes birds to repeat them. I have known dogs to perform almost anything they were told to do, although they are not able to utter a single sound of the words emitted in giving the command."

"Well, what is it that causes sound?"

"The most wonderful thing in nature is, that she manifests herself in only one way, namely, by a movement, or a motion of some kind. Vibration is the term used to designate this. Sound, light, heat, taste, smell, and everything which becomes sensible to us is produced by vibration. The movements of the heavenly bodies, swinging back and forth around the sun, like huge pendulums, the movement of the sap in trees, up and down, the beating of the heart, the winking eyelids are all motions which show energy, development, life."

"But what is it that makes us understand one sound from the others?"

"Simply the difference in the kind of vibration. There are three things which characterize sounds; namely, pitch, intensity and character. Pitch depends on the rapidity of the vibrations; intensity on the extent or the amplitude of the vibrations; and character on the substance or instrument producing them. To illustrate: When you sing a very high note the vibrations may be five thousand vibrations a second, or there may be only two thousand during that time. That represents the pitch. In singing that note you may sing it so loud that, like a pendulum, it will swing way over to one side, or it may move only a short distance. That represents intensity. If either you or George had sung that note I should have been able to detect it, whatever its pitch or intensity, because your voices are as unlike as different musical instruments, and that is character, or timbre, as the French call it."

CHAPTER III

THE HIDDEN MESSAGE

WHILE the work of getting out the planking for the boat was going on, and the plowing had now been resumed, since the new yoke of oxen were fitted to do the work, the boys were not forgetful of the usual weekly outing. They had several quite important things right at home which needed looking into, if they wanted to solve some of the things on the island. First, the cave, which they had twice attempted to explore; the search for their lost boat, which had the strange rope and oars; and the mystery of the flag and pole.

These things weighed heavily on their minds, because these happenings were close at hand. But what made the greatest impression on the minds of all was the finding of the *Investigator's* lifeboat. It seemed almost like a call to them from the interior. The impatience of the boys was almost beyond restraint at times.

"It does seem to me that we should not delay an hour in making some effort to explore the direction the boat came from," was George's view of the situation as they canvassed the subject.

"That is my idea, also, and I am not in favor of giving much more time to hunting or other forms of recreation until we know how that boat came to South River."

"Yes; I can appreciate how anxious you are," said the Professor, after the boys had given their

views. "What we are doing, however, is essential from every point of view. We must prepare provisions, so that we shall be able to know where we can get them in case of need. On the other hand, weapons are necessary, which take time to construct. If, however, it is thought advisable, we might make a trip of explorations along the South River, beyond the falls, the time to be limited to a week; but I have my doubts of the wisdom of such a course."

This suggestion appealed strongly to the boys, who were always keen for anything which savored of adventure, and it was some time before the boys could reconcile themselves to the saner and more business-like course of completing the boat and making the trip by water.

The weather was beautiful, and vegetation was springing up in abundant profusion everywhere. Magnificent showers fell at intervals, and the rainbows, more beautiful than any they had ever heretofore seen, spanned the heavens after the showers.

This had been noticed during the previous year, but now, after nine months of their life, with the wonderful insight which their needs had instilled into them, made them very observant of every phenomenon.

"I have often wondered," observed George, as he gazed at the beautiful broad band which formed a crescent across the heavens, "why there are never any rainbows in the middle of the day. They are never seen except in the morning or in the evening, and usually only in the evening."

"In order to understand that it will be neces-

sary to explain what a rainbow is. As I stated previously, light is merely vibration. Now colors are formed by the different lengths of the vibrations, just the same as the different musical notes are made by the different vibratory lengths. To understand this more fully, I make a sketch (Fig. 7), which shows just what I mean. You will see that red is the lowest musical pitch, which we will call C, and to the right is a long, wavy line. D, the next pitch higher, might resemble

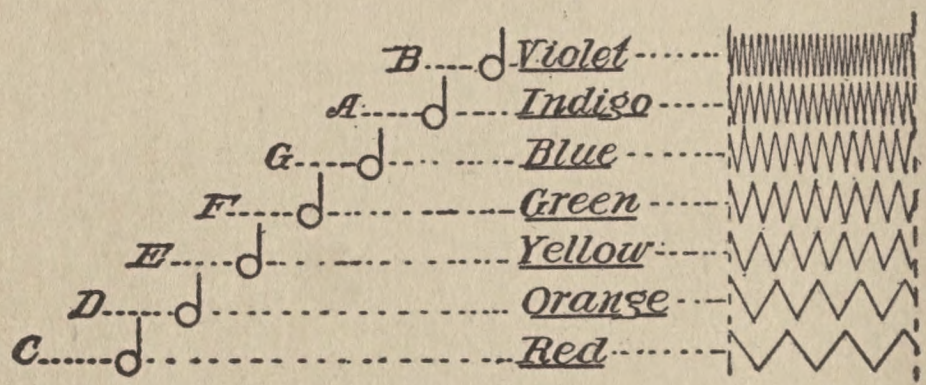


Fig. 7.

THE COLOR SPECTRUM

orange, with the wavy line a little shorter, and so on, until we reach the highest note in the scale, where the wave lengths are very short. You have probably noticed that a drop of water in the sunshine glistens, and, if closely observed, may have seen that it was colored, particularly blue or green. As the rays of the sun strike the globe of water, they produce different wave lengths, and in that way make it appear to you as being possessed of colors. Now, a rainbow is nothing more nor less than sunlight passing through the drops of water which are suspended in the air and causing a re-

fraction of the light. At noon the sun shines down from overhead, and we are not in the proper position to see this refracted light; but in the morning or in the evening the sun shines against the earth at an angle. At those times we are able to see the effect of refraction by the colors produced.

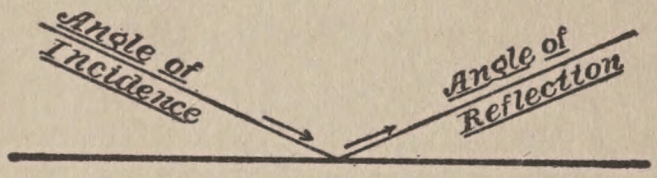


Fig. 8.

REFLECTION ANGLE

"When you throw a ball against a wall at an angle, it bounds away at the same angle. That is reflection, and is just exactly what light does when a ray strikes a mirror. If, on the other hand, the glass had no mercury on it to reflect the light, the ray would not go straight through, but would bend, just as you have seen a stick in a glass of water appearing as though it was bent below the water line. That is refraction."

Two weeks of very vigorous work had now been put in since the yaks had disappeared, and the wagon was still at the edge of the forest. George was anxious to recover it, with the new team, and with Harry started out early in the morning to make up as much as possible lost time, as every hour was considered valuable in their enterprises.

The yaks could be ridden as well as horses, but the greater part of the way were driven. One of the guns which had been completed was taken along, as well as the only pistol which the Professor had saved. In less than three hours the

forest was reached and they were soon within sight of the wagon.

"What have we there?" cried Harry, as they neared the spot.

"Our yaks! And where do you suppose they have been?"

Close by the wagon were the yaks, as though patiently waiting for the boys. They made no resistance, nor show of fright, when the boys approached. One of them, Jack, still had the strap tied to the horns, and it was the halter which had been attached to the tree at South River.

A hasty examination was made, but if either of the boys came to any conclusion concerning it, nothing was said. Without wasting time, the team brought with them was yoked up and the broken wheel replaced by a new one. The repairs to the wagon tongue did not take long, and they were ready for the return.

"What shall we do with Jack and Jill?" Those were the names bestowed on the first team. "Let us see if they will follow us."

They had gone fully one hundred feet before the yaks made any sign, and then slowly followed, thus assuring them that no care or attention would be required in that direction. Both boys were intensely delighted at the recovery of their favorites and could not get home fast enough to give the Professor the good news.

Nearing home, the Professor, who was on the watch, came out to meet them, waving his hat at the sight of Jack and Jill. When the latter came up he went over and affectionately petted the creatures, who seemed to realize the welcome.

"I hope they are as glad as we are; I can understand why they got away; look at the end of this thong." It plainly showed the teeth of some animal which had gnawed the leather of which it was made.

"So you have been out prospecting, too?" was Harry's query, as he saw the queer-looking reeds on the table in the laboratory that evening. "What do you call that?"

"Our honey has been getting low, and I took the occasion to-day to bring in some samples of sugar."

"Is that sugar cane?"

"Yes; the true sugar cane."

"Is that different from sorghum?"

"This is the species which grows in the southern part of the United States. The kind you know and which is cultivated in the Northern States, is the Chinese Sorgo, or, as we call it, sorghum. It is equal in quality and in quantity to the southern species and is readily treated to produce molasses or sugar."

"What is that peculiar flower, if it is a flower? I never saw a flower like that; it seems to be hard."

"I was surprised to find this. It is called the Tamarisk. This long, oval-shaped part is made by an insect which inhabits the plant, and is eaten by the inhabitants in the plains east of the Mediterranean Sea. It is there called Mount Sinai Manna, and is supposed to be the Manna which the Jews found when they were in the Wilderness after the Exodus."

"I think we have properly named this place Wonder Island."

In the volume preceding this, when they first

considered the building of a new boat, it was decided to graft an extension to the after part of their wrecked lifeboat; but when the second one was found, and calculations were made as to its usefulness, it was discovered that such a course would not be wise; hence the larger vessel was found to be the only solution.

The newly discovered boat was, however, a valuable addition, as it afforded a means by which short trips could be made, and Harry quietly set to work making a sail and rigging up a mast, so that the long-cherished desire to make these trips could be undertaken before they were ready to launch the real vessel. It was hauled up on shore and caulked and new parts added to make it adaptable for the purpose.

While engaged at this work he removed the cross seat which still remained, and in doing so was surprised to find a piece of cardboard which had been hidden, apparently, at the end of the board. Eagerly picking it up, he saw writing on it, with the following words: "We cannot hold out much longer. Wright and Walters were captured yesterday. WILL."

Harry could hardly contain himself, as he rushed up to the laboratory, crying out: "George, come here, quickly! I have found something!" Without waiting to see whether George heard, he rushed into the Professor's den with the paper in his outstretched hand. "Look at this; don't you remember Will Sayers? I am sure it is Will."

George heard his excited voice, and appeared without any delay.

"What is it now?"

The Professor was reading the scrap, and silently handed it to George. "Did you know either of the boys mentioned in this?"

Neither had any recollection of Wright or Walters, but they inferred that the writer must be Will Sayers, one of the companions. The Professor had no recollection of the boy, nor could he remember the other names.

"Let us examine every part of the boat," was the Professor's first suggestion. "We may find something more to give some clue."

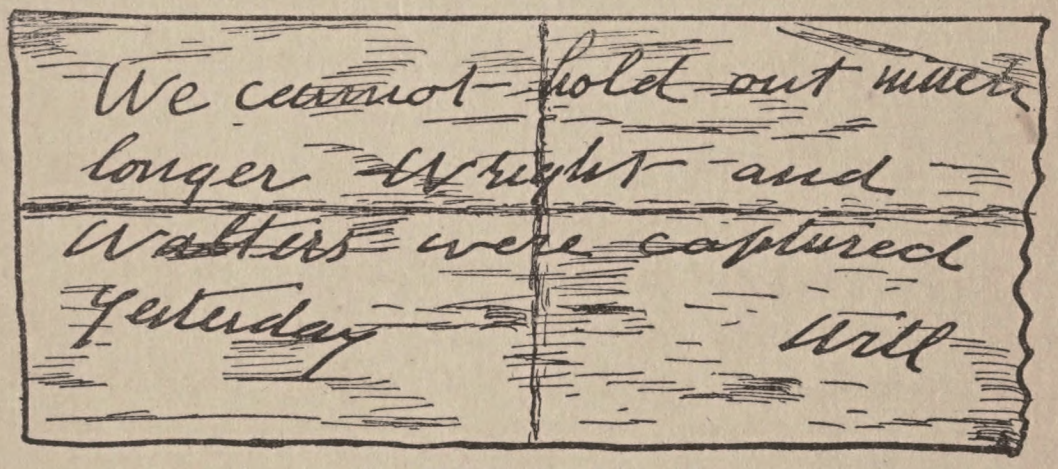


Fig. 9.

THE HIDDEN MESSAGE

The boys rushed down to the beach where the boat was moored, the Professor following.

"Show us the exact location of this strip."

"I had just taken off this cross seat, and as I did so this piece fell from the end."

"Let us put it back again and see how it fits into that place."

When it was replaced they noticed that a crack was left at each end of the seat, not exceeding an eighth of an inch.

"It is very plain that the piece you found was

at this end, and if it was folded as this crease indicates, it could have been concealed there and thus escaped our observation." After some minutes' examination, he continued: "This piece must have been there for some time."

"Why do you think so?"

"You will notice that the end of the board has the marks of the folded paper, showing it must have been in its place of concealment for some time. Furthermore, the paper itself indicates that it has been there for some time, by the discoloration on its outer side."

"How long do you think it may have been there?"

"It is impossible to say; but certainly for several months."

"Doesn't it seem reasonable," Harry inquired, "to think it was some one from the *Investigator?* Otherwise, how is it that they had possession of the boat?"

"That is the problem we shall now have to find out."

Thus, in another direction, was found an evidence that savages were on the island and that others had been wrecked and found a refuge there. How much of a refuge it was to them they had no means of knowing. They were thankful their own lives had been preserved and had been permitted to accomplish so much during their enforced stay.

"We are now vigorous and strong and have been blessed with energy as well as health. It is our first duty to take up the task of finding our comrades, whatever the cost may be. If that is

your view, we should proceed with that determination, but let us prepare for it in the best manner possible. How long will it take to finish the six guns you are now at?" said the Professor, looking at Harry.

"I will try to have them ready within another week," was his reply.

"In the meantime, George and I will prepare a new lot of powder; and for your further information, I will state that I have been busy during the past week in making preparations to extract some lead for bullets."

This announcement was hailed with joy. Heretofore they had to depend on the iron slugs which had been turned out, and they were not at all satisfactory, because they lacked the proper weight.

"Which is the lead?" asked George, who was examining the samples.

"It is this bluish-gray sample of galena, which, as you see, looks like lead itself, and is often mistaken for it; but it is far from being lead of the kind we can work."

"Why not?"

"Because it is in what is called a sulphide form. Do you remember what a sulphide is?"

"Yes; it is where it is in combination with something."

"That is a fairly good definition. More or less sulphur is found in all metals, but when found in large quantities the ore is called a sulphide."

"How can we get rid of the sulphur?"

"We can cook it and drive it off like steam. Lead melts at a low temperature, comparatively, about 600 degrees Fahrenheit, so that with our

furnaces it will be a very easy matter to get a pure lead."

During the rest of the day all were in the laboratory, superintending the preparation for the work, and at the Professor's suggestion the boys took the team in the morning and brought in over a hundred pounds of galena to be treated.

Before noon they had forty pounds of a very fine quality lead, and the work of making molds for the bullets was begun. The Professor, however, suggested that the boys should devote their time to the construction of the boat and guns, and it was difficult to decide what was the proper thing to do first.

The Professor saw the dilemma and had a very earnest conference on the subject.

"You must not, by any means, be carried away with undue eagerness and a desire for haste. The first essential of good business is to do everything in order. It is better to plan carefully every step in advance, so that you will know just when your energies will be required for the next step. An eminent engineer, on one occasion, in answer to a question as to why he was always prepared for an emergency, laid down this rule: Whenever you have a problem to solve, work it out in more ways than one. If one fails, you can apply the other immediately. This can be done without a moment's delay. Therein lies the answer—prepared ness."

The boys readily saw the force of the lesson. From that time on it was not necessary to direct the order of events. Each saw to it that the part allotted to him was carried out in a determined spirit.

CHAPTER IV

THE TERRIBLE MONSOONS

Of the two most urgent articles, namely, weapons or the boat, it was decided that the guns should be completed first. The feeling that the time would come when a visit from the savages might be expected at their home, contributed to this decision.

Six barrels, each eighteen inches long, and with a bore three-eighths of an inch in diameter, had been turned out, and several of the stocks had been made at odd times during the evenings. As Harry had sufficient steel left for four barrels more, two days were devoted to boring them out, in the hope that they would ultimately be able to finish them up. They would then have a battery of ten guns, and the necessity of having a number arose from the fact that they were muzzle-loaders, and could not be reloaded rapidly.

A sketch of the gun with the firing mechanism is furnished, in which it will be seen that the firing plug travels in a bore formed through the stock; in a line with the barrel. This plug had an upwardly extending finger, so it could be drawn back against the resistance of the spring. Below the plug was a trigger, with a hook-shaped forward end, in such a position that when the plug was drawn back the hook would catch and hold the plug until the lower right-angled projection of the trigger was pulled back. This would release the

plug, and the spring would then be driven forward and explode the cap.

"It would be well," said the Professor, "to polish the inside of the bored barrels, and thus make a much better weapon."

"How can we do this?" asked Harry.

"There are several ways, but the better plan would be to take a good polishing material, in the form of a fine sand or grit, and mix it with oil. This can then be put on a wiper which will snugly fit the bore, and the barrel may then be put in the

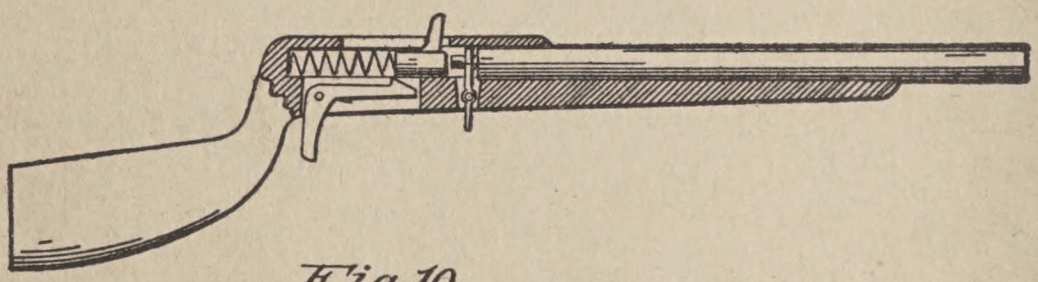


Fig. 10.

THE FIRST GUN

lathe and rotated at a high rate of speed with the wiper in the bore, and during the rotation the wiper is drawn in and out. This operation should be continued for an hour at least, frequently withdrawing it to add more of the polishing grit."

"What is the best grit to use?"

"If we can find a sample of the adamantine spar, in sufficient quantities, it would be the best substance."

"What kind of material is that?"

"It is a substance known as corundum."

"Is that the same as emery?"

"What is known as emery is the more or less impure product from the same source. I think I

have stated heretofore that both of these products come from the precious gems; the blue variety is known under the name of sapphire; the red as ruby; the yellow as oriental topaz, and the violet as oriental amethyst."

During that and the following day the Professor spent some time in prospecting for the gems, but if he succeeded in finding any samples he did not make the discovery known.

A few days after this Harry announced that he was ready to lay the keel of the new boat. All the material had been prepared, and was at the beach. Prior to this the island had been visited by a heavy storm. They had been frequent within the past month, but this was not considered unusual.

The Professor insisted that a temporary shed should be erected to cover the material, as moisture would make it very undesirable for the vessel, and a day was occupied in putting up the structure.

An entire week thus passed, every hour of which was devoted with the utmost diligence to the various enterprises. The keel was laid and the work of putting on the bottom boards was progressing rapidly. One night, a few days after the laying of the keel, a brisk wind sprang up, which continued during the night, increasing in fury, and in the morning evidences were seen on all sides of the effect of the tempest.

"It seems very singular," was George's observation, "that we should have such terrible winds here."

The Professor had evidently expected the

storms. "Do you remember the experience we had less than a year ago? We had five days of this on the ocean."

"I had forgotten that. Do they occur every year?"

"You may have heard of the monsoons, a periodical wind in the Indian Ocean, which is a northeast wind, and they blow with greater or less force from November to March."

"What causes them to blow with such regularity during those periods?"

"Ah! that is one of the things which it has been difficult to determine. They appear to be modifications of the trade winds. While, as stated, the northeast winds blow during the periods mentioned, they have the southwest monsoons, which blow from April to October. As these violent winds are the most tempestuous during the period when the sun crosses the equator, it has been argued that it is due to the action of the sun being in such a position that its rays strike the earth in the center of its rotation, thus heating up the air and causing it to rise rapidly along the middle belt."

"Is that what we understand by the equinoctial storms?"

"The equinoctial storms come in March and September, when the days and nights are of equal length."

"I was told by a teacher that the summers are longer north of the equator than south of it; is that true?"

"Yes; the summer north of the equator is about seven and a half days longer."

"What is the cause of that?"

"The earth is at its greatest distance from the sun during the summer months, and the angular motion of the earth in its orbit is slower. The result is, that the interval from the March to the September equinoxes is greater than from September to March."

Harry made his way through the violent wind and rain to the boat shed. He came back with a sorry-looking countenance. "I am afraid everything is soaked beyond recovery." He was almost on the verge of tears.

Before noon the rain abated somewhat, but the winds still blew strongly, and when they ventured out to take stock of their surroundings, George was the first to notice the disappearance of the flag on Observation Hill. Rushing in to the Professor, he cried: "Our flag is gone."

Harry was at the boathouse, and when George went down to inform him of the new calamity, he was almost heart-broken. The Professor, however, was not in the least perturbed. He laughingly chided them and soon restored the boys to their usual gay and happy demeanor.

"Such little incidents as we have met with this morning only give us variety. We need something of this kind to add zest to life. Just imagine what life would be if everything turned out just as you wanted it or willed it? You would commit suicide within a week."

The boys smiled, but at the same time their eyelids did double duty in the blinking line for a little while.

George straightened himself out and looked up

the hill. "Well, I am going for that flag whether it blows or not," and he started for the hill. Angel, who was in the loft, swung down and made his way out of the door, and before George had gone fifty feet, was at his heels. "And you are going, too? Good boy!" and George actually hugged Angel. He understood.

Arriving at the hill he made an examination, and found that the halliards had been broken and the wind carried away the flag, halliards and all. As the wind came from the sea, the flag must be inland somewhere. Search was made in every direction, but to no purpose. Every rock and lodging place was examined, but it had disappeared. Angel was an interested searcher. He really seemed to divine George's mission. At every bush, or rock, or other possible landing place, he would be the first, and peer around, and look up and down, just as he had seen George do.

The quest kept up for over an hour, and, sadly disappointed, he returned with the news of his failure. The Professor took the loss lightly. "I presume it is intended that we should work out our own rescue. After all, I think that is the proper thing to do. If we depend on others we are sure to meet with disappointment and failure. Cheer up, boys; flag or no flag, let us do our duty."

"I don't mind the loss of the flag so much because it prevents us from having a signal, but I hate to think that we lost so much good time in making and putting it up."

The flag alluded to was sixteen feet long, laboriously made out of ramie fiber, which was woven, and then dyed, and it was a hard task to haul the

pole, which was over fifty feet long, from the forest ten miles away, to say nothing of the labor required to raise it.

As soon as the thoroughly drenched material at the boathouse could be brought out and dried in the sun, which now came out bright and warm, the work proceeded with renewed vigor. Late that evening the Professor appeared at the rear of the laboratory, and called loudly to the boys.

When they appeared at the laboratory he was laughing immoderately, and Angel stood on one of the tables with a simian grin.

"What is the matter? Has Angel been experimenting again?"

Before the Professor could answer, George caught sight of the flag.

"What! The flag! Where did you get it?"

"Ask Angel."

The boys laughed, and George actually hugged the animal, in his delight. Did Angel know what he had done? Ask those delvers into the mysterious realms of thought, what prompted him to search for and restore the flag? Is that any more remarkable than the recorded tricks of dogs and many other animals?

You know just how boys can laugh when they are really happy. Angel imitated that laugh, and he had not been taught to do it, either. It came without teaching.

When the Professor had wiped away some of the tears which had come from the excess of laughter at the imitating efforts of the animal, he said:

"Did it ever occur to you why Angel has always

had a solemn look? The facial expression seldom, if ever, changes, and they rarely ever exhibit mirth. You may imagine the condition of those animals, living in the forests, with enemies all about them, and the struggle for existence an everlasting one. They have never known amusing incidents as we understand them. Naturally, the muscles of mobility in the face, which express pleasure, never have been exercised, and those indicating fear and anger unduly developed. Here is Angel, in a new atmosphere, where he sees delight depicted on the countenance, and, gifted as he is, with wonderful powers of imitation, has learned to actually laugh, and to enjoy the scene."

"Well, Professor, as we have one of the guns polished up and completed, wouldn't it be well to make the bullets?"

"For that purpose I suggest that we make the molds out of a metal or alloy which has a higher fusing point than lead."

"What is best for the purpose?"

"We might make an alloy of copper and zinc."

"Oh! You mean brass?"

"Yes; that is readily cast and easily worked."

"But what shape shall we make the bullets?"

"They should be made long, with a pointed forward end."

"Why is a long bullet better than a round or globe-shaped ball?"

"There are several very important reasons. First, momentum is a prime element in a missile. A long one contains double the metal of a spherical one. Second, it can be made so that it will ex-

pand when the explosion of the powder takes place."

"In what way does it expand?"

"You have noticed that the rear end of the bullet has a cavity. When the explosion takes place the thin shell at the rear end of the bullet expands, so that it tightly hugs the bore of the gun."

"What is the object of having it do that?"

"To give the ball the benefit of the charge of powder exploded. If it does not fit tightly in the bore, more or less of the powder will pass the ball, and thus the ball loses part of its force."

"What is the object of rifling the gun?"

"The object is to impart to the bullet a spiral motion, as it moves through the air. Metals have not the same density on all sides and this is particularly true of molded balls. As a result, when projected from the gun, the heaviest side has a tendency to divert the ball and make it more or less erratic in its motion, and, therefore, inaccurate. The spiral motion has the effect of minimizing this difficulty. The cavity formed at the rear of the projectile was devised particularly to cause the thin lip of the bullet to be driven into the grooves formed in the gun barrel, and by that means the boring motion was transmitted to the bullet."

"But as we have no means of rifling our guns, there will be no necessity of putting the cavity in the rear end of our bullets."

"We must have the cavity there, by all means."

"What for?"

"Simply because we do not want the bullet to

turn around and travel end over end after it leaves the gun."

"How does the cavity prevent this?"

"You have probably forgotten that a body travels through the air with its heaviest end foremost. When a cavity is made it is lighter at that end. Without the cavity, if the forward end is pointed, it will, on leaving the gun, turn around and go through the air with the blunt end foremost."

The molds were made, as directed, of a hard brass composition, and when they were ready to cast them the Professor cautioned against making any castings with the molds in any position except upright, so that any inequality in the density of the metal would not form itself on the side of the cast article.

Quite a time had now elapsed since the last exploration of the cave beyond Observation Hill. The Professor had spoken about it on several occasions. For some reason he was intensely interested in doing that. In fact, he appeared to be more concerned about that than any other of the unknown things about the island.

The boys could not understand this peculiarity. He had never been questioned on the subject directly, but it was evident he had a reason for this predominating wish to continue the exploration.

George was just as much interested, but, as the sequel will show, for an entirely different reason. Ever restless, and always willing to undertake anything which promised to delve into hidden

things, he approached the Professor one day with the suggestion about the cave.

"I think we ought to take one day off and go to the cave."

The Professor was interested at once. "It will not do to attempt it now."

"And why not?"

"I am afraid we could not get in very far, unless we had a boat."

"Then why not use our lifeboat?"

This suggestion met with instant favor. "True, I had forgotten about that."

Fig. 11.

THE BULLET

It did not take George long to reach Harry with the news that the cave was to be explored by means of the boat. After considering the matter for some time it was decided to put off the trip for several days at least, principally because the late heavy rains had, in all probability, so filled the cave that they might be stopped in their progress before going very far.

It should be stated that when they entered the cave the first time, water was found about two hundred feet from its mouth and that barred their further progress. On the second trip the water had receded, so they could go in six hundred feet

before coming to the water's edge. The late rains may have filled the cavities, thus making progress still more difficult.

Harry was carrying forward the boat construction, and by the occasional aid of George was bringing the hull to a completed state. While this was being done, George was at work with the loom, slowly weaving out the fabric for the

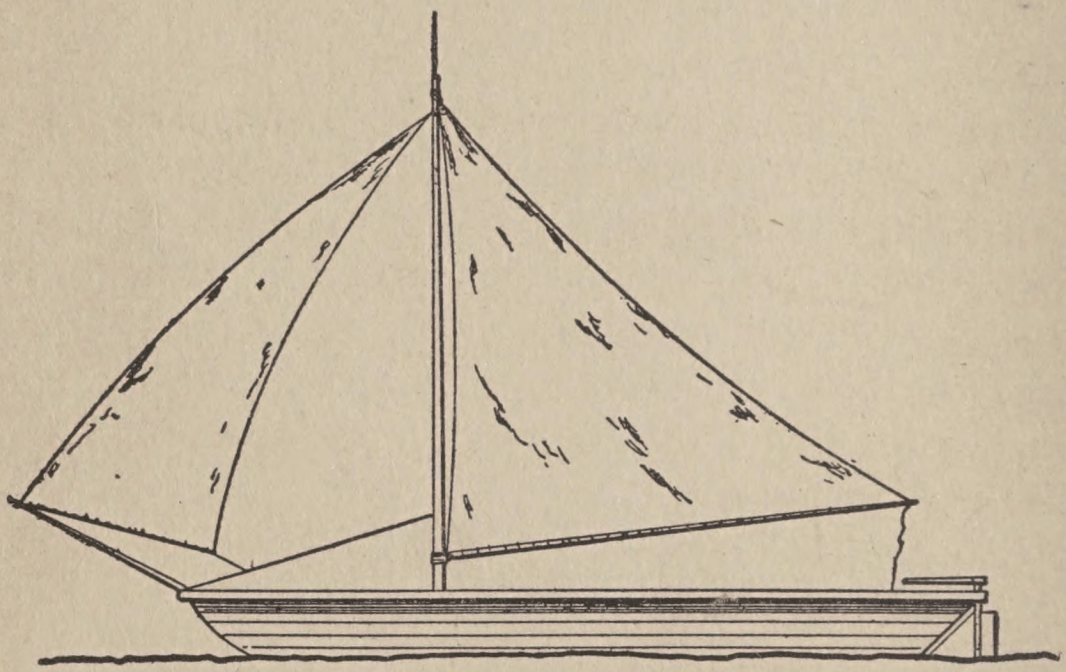


Fig. 12.

THE SEA-GOING BOAT

sails. As the mast had been stepped back over six feet from the prow, it was concluded to make a mainsail and a jib, a small triangular sail which is attached to the forwardly projecting jib-boom. The two sails would afford greater speed than a single sail, and that was one consideration. The other was, that with two sails the mast would not need to be so long, and the dimension of the mainsail could be reduced, and still get the same efficiency.

The weaving of a large sail in one piece was impossible, as the loom could turn out goods only thirty inches wide, and as it could be operated by hand power solely, it will be seen that the sails required not only time, but an immense amount of patience. It is no wonder that George was anxious to take a day off at the cave, or anywhere else that afforded a change.

While at work Angel was his constant companion. It is remarkable what a degree of friendship and companionship grew up between the two. In the course of time the weaving process became so familiar to Angel that whenever George would throw the bobbin, containing the weft, through the opening of the woof threads, the animal stood ready to pull the heddles forward, so as to force the last weft thread up against the one previously threaded across.

CHAPTER V

THE VOYAGE FOR THE BENEFIT OF ANGEL, AND THE DISCOVERY

WITHIN the next week the boat hull was practically completed, and now needed caulking. For this purpose the hemp, which had been found, as previously stated, was broken up, and as much of the woody portions removed as could be taken out, so as to make it available for filling in the crevices between the planking.

The mast was stepped in, and a sufficient quantity of manilla rope twisted for the sails, and also a supply put aboard for other needs. The sails were not yet completed, but they would doubtless be ready by the time the other parts were.

In one of their evening conferences George expressed his concern about the future of Angel.

"For my part I do not want to leave him behind."

"Then why not take him with us?" asked the Professor.

Harry had some doubts on this point, but George was too insistent to brook any thought of leaving him behind.

"I make this suggestion, George: Before the time of sailing it would be advisable for you to make several trips with Angel in the small boat, and see how he behaves. In some respects he would be an acquisition to us."

The boys had not forgotten how the animal,

during their various trips, had been of material assistance, nor the times when nutting how Angel understood what they were after, and would climb trees and shower them down, and then gravely help to load them into the wagon; and they remembered the recovery of the flag. Such service was appreciated.

As it was, Angel was invited to take a sail. The lifeboat recovered in South River had been named No. 2, as they insisted on calling their own wrecked vessel No. 1.

No. 2 was launched. A small sail had been rigged up, and two good oars provided for it. Angel was completely at the command of George, and when he was called and taken down to the landing in front of the boathouse, he went without any hesitancy. But to induce him to enter the boat was another matter.

Suspecting there would be some difficulty, George pulled a small jar of honey from his pocket, and silently began to eat it. Angel's eyes blinked. It was such an unheard of thing for George to do this without extending an invitation to join. He shambled over, but George walked to the boat and sat down in it, not appearing to notice the eager look on the animal's face.

Without further urging he stepped aboard, and George put his arm around him, as Harry, with oar in hand, pushed the boat from the shore. Angel was startled, and tried to get away, but soothing words soon quieted him, and before they reached the mouth of the Cataract he was leaning over the gunwale and playing with the water in the most approved boy-like fashion.

When, however, they had passed the comparatively calm waters in the estuary, and were rounding the cliffs, poor Angel forgot his sport, and sat as one paralyzed, gazing at the sight of the waves beating against the shore line. George went up to him, and spoke encouragingly, and it was fully a half hour before he was restored to his usual calm. Then, apparently, he noticed for the first time the peculiar rocking motion of the vessel. Every time it swayed to the right or to the left he would give that peculiar chuckle which always indicated delight.

They went around the point to the east, and passed down the coast in a southerly direction, going as far as the cape north and east of the mouth of South River.

"Steer for the shore, George; steer for the shore; what is that to the right?" said Harry, pointing to the beach.

"It looks like a boat, sure enough."

As the wind was coming directly from the shore they had to depend on the oars to bring the vessel around, and as they came in could distinctly make out the side of a boat lying among debris, in an inclined position, against a rather steep beach.

"It is our boat, Harry." The moment their vessel came alongside, Angel jumped off and leaped over to the boat on the shore. Evidently he also had recognized it.

"Well, isn't this a find?"

"How long do you suppose this has been here? I am glad we gave Angel an outing."

"Shall we take it with us?"

"Yes; if we have to carry it overland," was Harry's reply.

"Let us float it."

It was not much of a task to do this, and with a short rope it was hitched to the stern of No. 2. Angel remained in the recovered boat, and when No. 2 was pushed from the shore, and the sail set, its movement did not seem to perturb him in the least, but when the oscillations again began to be perceptible, he commenced to gurgle, and George knew they had a good sailor to take with them.

The sail took a little over three hours, and as they passed up the Cataract River, and approached their home, the boys set up a welcoming shriek, in imitation of incoming steamers, which so delighted Angel that he scampered in a delirium of joy from one end of the craft to the other. It is doubtful whether he had ever in his short life had such a glorious time, and that he remembered it his subsequent history furnishes the best evidence.

The Professor was just as much delighted as the boys at the sight of their first marine production, which had gotten away from them and stranded them on the cliffs three months before. "I am sorry now that you named the other boats, because this is really No. 1."

"Never mind; this is good enough to be No. 3. Just look at our navy!"

"Where did you find it?"

"Near the point, south of the bay."

"Then it must have been washed there during the late storms, because I do not think it is possible that it could have gone there at the time it

escaped you, as the wind was blowing directly to the west at that time."

The boys now remembered the circumstance, and as they recalled the condition of the driftwood around it when they found it on the beach, it was plain that the storm had been their friend in this case.

"Have you been using oars on the boat?" was the Professor's inquiry, as he bent over the side and examined the notches which were made for the oars.

"No; why do you ask?"

"This boat has been used by some one, and not very long ago, at that. Notice how the forward sides of these notches are worn. It also seems that civilized people have been using the boat."

The information was so startling that neither of the boys could answer for a moment. Did they have another mystery to contend with?

But George was alert on the questioning end of any proposition. "Do you really think white people have had the boat? I do not see anything that would make you think so."

"If they were savages they wouldn't use the oar-locks or notches, as they row free-hand, almost without exception; but get a white man in a boat, and the first thing he looks for is a place to put his oars in. This incident in itself shows one of the distinguishing features between the civilized and the uncivilized people."

"In what way is one civilized and the other not?"

"I did not say one was civilized and the other uncivilized. The most wonderful thing in the ad-

vancement of the human race from a state of savagery to civilization, was the discovery and utilization of a fulcrum. Whenever man, in an advanced state, undertakes to do anything, he uses a fulcrum of some kind."

"In what way is it so useful?"

"Primarily, in the form of a wedge, a pulley, a wheel and axle, an inclined plane, a screw or a lever. All these forms do the same thing as the simple lever; and what sort of mechanism could be made without some of these elements? The row-lock is simply the fulcrum for the oar, is it not?· When Archimedes discovered the principles of the lever, he was so excited that he declared he could move the earth if he could find a fulcrum."

A careful examination of the notched gunwale showed conclusively that it had been used to a considerable extent. George sat and pondered over this. "I am sure we never used the boat enough with the oars to wear it in this way. Had you examined this when you said that the boat had not been long at the point where we found it?"

"No," answered the Professor; "I simply remembered that on the day you lost it the wind was blowing to the west, and as you found it to the east of the cliffs, I inferred it must have been carried around since that time."

"It is evident then that the people who used this boat live to the west of us?"

"That is my only conclusion."

"Then you think the fire in the forest, and the

light which we saw that night beyond the West River, were made by those people?"

"I am sure the fire we saw was made by savages, but I am not so certain about the lights having been made by them."

Harry looked at the Professor, and then at George, and slowly shook his head. "Wasn't it lucky we didn't meet them when we made our trip to the river?"

That evening the inevitable subject of their forthcoming voyage was again discussed, and to the surprise of the boys, the Professor urged delay. His reasons were expressed as follows:

"While we have had some very severe storms of the kind which may be expected, we are not sure that the weather is yet fully settled. That is the only reason I urge delay. If, on the other hand, we should decide to take an overland journey, we could set out at once."

Harry was opposed to taking another trip by land. "We have really found out more by the water route than going by land. For that reason it would be well for us to make at least one adventure by sea."

These arguments prevailed in the minds of all, and while it would take some time before all preparations could be made, all were happy at the thought that when they did undertake the journey something definite would be learned to clear up a few of the mysteries of Wonder Island.

The Professor did find some samples of tourmaline, in a finely divided state, and this gem was used to polish the gun barrels, so that all the weapons were finally put into condition where

they could be used. During an hour each day all took a part in practicing in a range specially prepared near the workshop. Distances were laid off accurately, and the regulation targets set up. In this manner they became accustomed to loading and firing with facility and a considerable degree of accuracy.

If anyone, not knowing the situation, had dropped in on this scene, he would have considered himself in the midst of a great naval and military camp. At the workshop were the guns, arranged in order; boxes provided for the bullets; small turned out wooden cups for powder, each cup carrying twenty little tubes of bamboo, each with a measured charge of powder, and longer bamboo tubes with percussion caps in them.

It was Harry's brilliant idea to separate each charge of powder and put it into a special tube. This tube had one end closed, and the other provided with a stopper, so that in loading the stopper could be drawn out and held by the teeth while the powder was poured into the gun. The caps were put into a bamboo tube which was just large enough to take the caps, which were dropped in, one after the other, and it can be seen that it would be an easy matter to turn the tube upside down, and thus bring out one cap at a time. This also facilitated the reloading of the gun.

During the practice with the gun one serious defect was found; and that was to remove the cap after each shot. Sometimes the body of the cap would not split, and as a result, a knife or some pointed instrument would have to be employed to dislodge it so as to make room for the new cap.

Harry found a way to remedy this. An opening was made through the stock at one side, and a sliding piece, like a collar, put over the nipple which holds the cap. A finger attached to this collar enabled the marksman to draw back the collar, and this would bring with it the cap, which would then fall out of the side opening.

All these little details may seem to be useless care, but rapidity in loading and firing, with muzzle-loaders, in an engagement might be their salvation.

A test was made of the improved firearm, to determine how fast the gun could be loaded and fired. The test made by Harry showed that it took two seconds, after a shot, to bring down the piece, and draw back the collar to release the cap; three seconds to grasp one of the powder tubes, remove the stopper and bring it to the muzzle of the gun; two seconds to pour in the powder; two seconds to drop the tube in its receptacle and grasp the bullet; two seconds to ram it home, and three seconds to put on the cap and cock the gun for firing. That was nearly a quarter of a minute.

He was very much dissatisfied with this exhibition of speed—or rather of slowness, so after considering the matter for some time, hit upon the plan of reducing the rear end of the bullet, so he could wrap a paper tube on that and tie it. Then he purposed filling the tube with powder, and closing the rear end by folding over the end of the tube. In this way he would entirely overcome the need of the little bamboo tubes for holding the powder.

But no paper was available, nor could he think

of anything which could be used as a substitute. In despair he repaired to the Professor.

"What is the difficulty now?" said the Professor, with a smile.

"No difficulty, particularly, but I wish we could have paper, or something like it. I want to make cartridges."

"I thought you had all that arranged for?"

"So I did, but it takes me a quarter of a minute to load, and I must do better than that."

He mused a while. "We could make paper, and I think we have the facilities at hand for doing it; but it will take quite a time to arrange for it. Aside from that I do not, at this moment, know of anything which will be a fair substitute."

He was chagrined at this failure. But, after all, four shots a minute were not so bad. The perfection of the guns must await their return.

Now, let us go down to the marine works, on the shore below the Cataract. Here were the three vessels lined up side by side, and also the after part of the lifeboat. The shed, which was the boathouse, had nearly all their tools, and besides the bench, was a forge and the primitive blower which the Professor and George had made and set up. Wood, parts of planks, thin boards, of all sorts and description, were scattered about. It looked business-like, and Harry was intensely proud of it.

The sail was completed, and taken down to be bent on the cable. The jib had already been installed in place, and when the sails were hoisted and they walked out from the shore and glanced back to get a full view, the entire Naval Bureau

congratulated itself on the magnificent appearance of the fleet, and particularly of the new creation in maritime architecture.

It is not out of place to say that the Professor and George both showered the highest compliments on Harry, for he deserved it. But the officials of the establishment were not the only ones to admire the fine sight. Angel came, and he took it in. It was the finest climbing he had enjoyed in many a day. The Professor took off his hat. "I propose three cheers for our ship."

They were given, and with each cheer the hats circled their heads. This was a new code of procedure to Angel. He couldn't understand it. Without waiting for explanations, he shot down the mast, and landed on shore. It was the most comical proceeding they had ever witnessed on his part, and when he looked at the group, and then at the ship, he said as plainly as though he had uttered it: "What does all this mean?"

When the laughter was over, George proposed three cheers for Angel. The hats came off and the cheers were given. Then the same smile which he had so well learned illuminated his projecting face, and he swung his long arm around as he had seen it done, and another step had been taken in his education.

CHAPTER VI

THE GRUESOME FINDS IN THE CAVE

ANOTHER week had thus passed by—seven days of unceasing toil. The Professor again brought up the subject of the cave. The subject did not need any argument. It fell on willing ears.

"How shall we take the boat around?" was the matter which interested George.

"Sail it around, of course," was Harry's view.

Both looked at the Professor. "If we sail it there, which will be an easy matter, how can we haul it up the sides of the cliffs? From my present recollection the mouth of the cave is fully thirty feet or more from the water line. The air pocket is not over eight or ten feet. At any rate, it is much lower."

"Then why not haul it around on the wagon, and lower it down the walls?"

"That seems the most feasible plan."

They now knew what preparations were needed for the exploration. Two lamps had been taken before, and one was lost in the cave. Since that several more had been made, so that three were provided, together with a supply of matches.

When the wagon was ready the Professor brought out several boards, and deposited them in the wagon. The boys looked at the boards inquiringly, as the Professor turned back from the wagon. "Oh, yes, the boards; we want something

to write on so that we can chart the cave. We must not be caught as we were the last time."

"But how can we possibly chart the cave when we have only one boat?" And George laughed at the idea of making a plan of the interior by standing at one point.

"You measured the height of the falls without going to the top, if you will remember."

He had forgotten that. But the boat was at last secured in the wagon, and proceeded to the cliffs. It was fortunate that the team could be taken to a point directly over the mouth of the cave, and in a little while the ropes were attached to it and slowly lowered, Harry taking the precaution to follow it down and to dislodge it from the steps which appeared in its path.

The team was then securely hitched, and taking all their implements, such as lamps and boards, together with two of the guns and an ample supply of ammunition, descended to the entrance. The boat was at the mouth, and it was suggested that a preliminary survey of the interior should first be made, in order to ascertain how far the boat would have to be carried before reaching the water.

The lamps were lighted, and the boys led the way. After passing the point, about two hundred feet from the mouth, and at almost the identical spot where the water was found at the first exploration, the water glistened before them. Returning toward the opening a loud beating sound was heard, which at first startled them. It was evidently at the mouth of the cave. It sounded

like the beating of a stick against some hard substance.

The nearer they came to daylight, the more distinct were the sounds. As heretofore explained, near the entrance the cave made a turn to the right at an angle, so that when at a distance of fifty feet from the opening it was impossible to see daylight, except what little was diffracted from the angle at the turn.

This angle was reached, and the beating, rather irregular, was plain enough to cause some alarm. The boat was beyond the open mouth and at one side, so that it could not be seen by anyone within the recessed walls.

All stood still, while the beatings continued. Occasionally there would be a cessation, to be repeated again. Whatever it was it was not far away. The Professor whispered: "Get the guns ready; we must take some chances."

Cautiously the company moved forward; the end of the boat first appeared in sight, and as George peered beyond the projecting point of the ledge, he threw up his hands and burst out in laughter. Angel was in the boat, imitating Harry in the building operation. The sudden appearance did not startle him in the least, nor did ne stop beating his lullaby, after he noticed the broad smiles that greeted him.

With an eye to every advantage, Harry had attached to the sides of the boat, amidships, two short standards, about three feet high, on top of which two of the lamps were mounted, so they would be out of the way, and thus give them freedom to handle the oars and the weapons, as well

as afford them a better light, than if carried by hand. The Professor was much pleased with this arrangement.

The boat was not particularly heavy, but it was a task to drag it over the uneven floor and along the tortuous path which had to be taken by their burden, but when the water was reached they were repaid for the labor by the ease with which they could explore the interior.

Before starting the journey the Professor, as usual, uttered a few words of advice: "One of us must sit in the bow, one at the stern, and the other amidships. The one at the stern must propel the boat, as we cannot row through many of the places, and as the water is not deep, that will not be a difficult task. The ones at the bow and amidships should have the guns, and if there is no objection, I will take my place on the middle seat, where I can best take the observations on the way. The other places you should decide between yourselves."

"I am willing to take the bow, if Harry agrees." Harry sanctioned the arrangement, and when the lamps were securely fastened, Harry pushed the boat forward through the cavern. It did not take long to reach the slight turn which led to the large chamber, which was over one hundred feet long.

On the way to the chamber Harry had an opportunity to measure the depths of the water, and at intervals the Professor would call out for the depths, as he was making notes of the descent formed by the floor to the chamber. The oars gave a pretty fair idea, showing that the floor

was only about five feet lower at the chamber than where the boat was launched.

Reaching the chamber Harry was directed to steer it to the right and skirt the wall going to the left, so that every part of it could be examined.

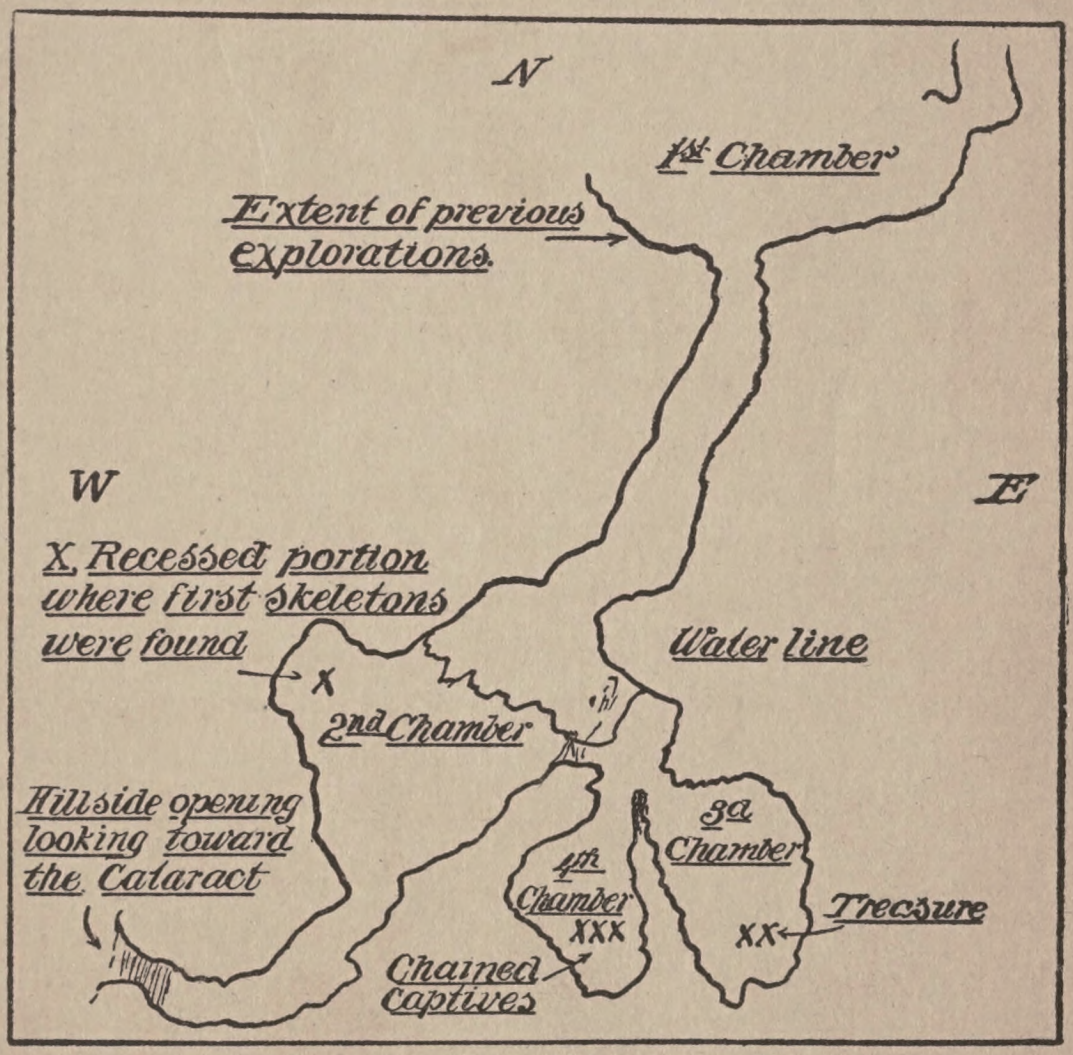


Fig. 18.

THE TREASURE CAVE

"I have another reason for this careful examination," remarked the Professor, as he was intently engaged in making notes on the board tablets. It may be likely that the chamber has more than one outlet, and if so, we must explore it also. Of

course, I am most interested in the outlet to the south."

A circuit was made until they reached the outlet to the south, which Harry had discovered when the light on the ledge disappeared. The water throughout the cavern within the chamber was not over eight feet deep, and at the outlet to the south he could not touch bottom with the twelve-foot pole they carried. This outlet was contracted, and, judging from the width of the boat, could not be more than eight feet across, but it gradually widened, and the waters became shallower as they advanced.

George, who was in the bow, held up his hand as a warning. "Stop!" was all he said. All peered forward. The lights threw their beams forwardly through a broadening channel, beyond which appeared to be white forms ranged along the opposite wall.

"What depth have you, Harry?" asked the Professor, without seeming at all concerned.

"About five feet."

"Move straight ahead, until I tell you to stop."

The pole was thrust down and the boat moved forwardly fully fifty feet before a halt was called.

"I think we are now in the middle of this chamber. Before exploring it let us make a thorough examination of its characteristics."

"Look at those wonderful icicles hanging from the roof!" George gazed on them with wonder and admiration. Harry, on the other hand, with the utilitarian idea in his mind, inquired: "Why couldn't all that chalk be utilized for making plaster?"

"That product is used in the arts, but it costs too much to transport it from the places where it is found in its natural state, as science has found a much cheaper way of producing it from limestone."

"Are all these rocks limestone?"

"Beyond question. Only a few of the caves so far found are in any other formation than limestone."

"What kind of cave are those?"

"Where they have been produced by volcanic action. There the walls are of volcanic rock."

"Why is it that these underground channels are formed in this way?"

"They are formed by the erosive action of the water wearing out the softer portions of the rock beneath a harder roof or wall. This action is brought about by carbonic acid acting on the rock and producing what is called carbonate of lime, and the stalactites and stalagmites found in all these caverns are of that material."

"What is the difference between the two names you have just mentioned?"

"Stalactite means trickling or dropping, and as applied to these formations it means conical or cylindrical accretions of the carbonate. Stalagmite is the term used to designate the calcareous formations found on the floors of caverns, which are usually the droppings from the roof."

"Where are most of the caves found?"

"They occur most frequently along rocky shores of open seas, as in this case. Some of them are celebrated for their great extent, others for their gorgeous interiors, like this chamber. Some show

the most beautiful draperies, or veils; in some cases portions of the ceiling have representations of magnificent inverted candelabra, and what appear to be carvings in the purest white."

"In what parts of the world are most of them found?"

"It does not seem that any portion of the world has a monopoly. The most celebrated are the grotto of Antiparas, in Greece; the Adelsberg caverns in Carniola, and the Mammoth in Kentucky, The latter is the largest in the world, the windings of which extend forty miles and through which is a subterranean river. In the river are eyeless fish, and fish with eyes, but sightless. Others are the Luray, in Virginia; the Wyandotte, in Indiana; Weir's, in Virginia; the Big Saltpeter, in Missouri, and Ball's, in New York. Of seashore caverns, the most famous and remarkable is Fingal's, on the coast of Scotland. Extensive caves are also found in the Azores, Canary Islands, in Iceland, in various portions of England, France and Belgium. Many of them are of immense value to the paleontologist."

"In what way are they of any use?"

"They have been of the greatest service, because in the early days of man, and before he knew enough to build his own habitation, he made the cave his home. You have heard of the 'cave man,' have you not? During the old stone period in England and other European countries, these caverns were the only abodes of man, and in them have been found layers from twenty to thirty feet thick, of successive accretions of bone, stalagmites and various articles of human manufacture."

This information added interest to the examination of the walls, and the eagerness of the boys to discover something new and startling was at its keenest edge. Before they had made a half circuit George announced that he could see a large opening, which turned to the right, and thus formed a bend to the general direction that the cavern had made.

A digression is necessary, in order to be able to understand all the elements in this remarkable voyage. The mouth of the cave was northeast of the Cataract home, and distant about a half mile, in a straight line. The opening for the first six hundred feet, which had been charted by them on the previous occasion, ran directly south, but from that point it turned toward the southwest, and this now, in a measure, explained the eagerness of the Professor to explore it, as he believed the cavern led to a point near their home.

"There is no water in the opening," was the further information from George, as they approached the contracted end of the chamber.

"Before we land let us see the other side of the chamber," was the Professor's suggestion.

The boat was veered around to the left, and before they had proceeded fifty feet it was apparent that a similar opening led out to the south, and a dry floor was visible, like in the other outlet. The boat was landed, and drawn up, two of the lamps taken out and the guns examined. The opening led into a second chamber, which looked like a canopied grotto of marble. Where they stood the chamber had the appearance of a huge letter A, the side walls of which ran together in

the distance, but these walls were broken up by the most enchanting series of columns, and delicate entablatures, and the outlines of the figures were like blanched frescoes. It was such a weird and startling sight that the boys could not repress their amazement.

After they had fully entered the chamber Harry's quick eye caught a peculiar formation to the right, on a raised sort of platform, behind which seemed to be a recess. He had noticed it because it contrasted so strangely with the uniformly white glare of all the surrounding surfaces. He quickly made his way across, and as he reached it, stepped back in alarm.

"Come here, quickly; are those skulls and skeletons?"

The Professor did not need a second invitation. Scattered about on the elevation were found four skulls, and the bones comprising the remains of four human beings. The skulls were first arranged side by side, and the Professor intently examined them.

"These are skulls of the Caucasian race, beyond a doubt. All are, apparently, well formed and normal. But what is this?"

In the side of one skull was a perforation, with the bone fractured on all sides of the orifice.

"Do you think it is a bullet wound?"

"It has that appearance. As there seems to be no corresponding hole in any other portion of the skull, we may be able to find the missile inside, if death was caused by that means."

Harry had noticed a rattling sound when the skull was put in place, and mentioned this. After

some hesitation the course of the fractured opening was traced through, and embedded near the top and on the opposite side, was a large lead ball, or what had been, undoubtedly, spherically shaped before it entered and passed through the bones.

"This is evidence to me that these remains have been here a long time."

"Why; because it is in the form of a ball, and not a bullet?"

"Yes; and there is also another reason why these people came here and met their fate many, many years ago."

"What is that?"

"In this calcareous formation the preservative qualities of the carbonates would prevent rapid decomposition. These skulls are turning to the same material that we see all about us. See how brittle the bones are. Our bones are of lime formation, being largely composed of the carbonate, the same as the stalactites."

The other substances now lying about were noticed. The excitement engendered at the sight of the bones was enough temporarily to blind them to the numerous things found scattered about. Here was a dirk, the edges entirely worn away, and whitened. There were the metal ribs of what seemed to be a case, or a receptacle of some kind. Lying at one side was an ancient type of firearm, long, heavy, and with an immense bore. Another and another were found—a regular arsenal, with the scattered remnants of peculiar little copper receptacles with whitish powder in them.

Harry, who was about to remove the powder, was stopped by the Professor. "We must retain everything as we find it, as nearly as possible. We do not yet know what the little vessels contain."

Not an article of clothing thus far had been found. A little higher up on the platform, two more skeletons were seen, both of which had fractured skulls, one of them showing two cavities which could not have been accidental, as both showed the same kind of fracture, and inclined across the skull in the same direction on the left side.

Alongside these skeletons were more of the long, wicked-looking firearms which had been found previously near the other bodies. There was every evidence to show that a terrible fight had terminated the existence of the band. More long knives, with curiously wrought handles, were lying behind the last skeletons, and on a more careful examination, a knife of an entirely different pattern was found within the ribbed cavity of one of them.

Still farther back, new articles appeared. Articles of furniture, many of them coated with the fallen carbonates; and here were the first articles of clothing, some of which were so decomposed as to crumble at the touch. Others were still firm. Some of the articles, like a mantle, had threads intact running in one direction, and the other cross thread all converted into dust, which disappeared when the garment was held up.

On some of the garments were metal trimmings. "They look like silver," said George, excitedly;

"and what is this? It seems to be silver," as he brushed a bracelet-like piece of ornamentation with the sleeve of his coat. As they advanced new articles came in sight; a bench; a veritable chair, or couch, the covering of which was there merely to give it form, but the substance had gone. Only the wood remained and that largely decayed.

And now on every side, at the rear and along the walls of the recess, were evidences of human habitation. Cutlasses, knives, and at one side, what appeared to be the kitchen, were numerous pots and kettles of various sizes and descriptions, nearly all of them of copper.

"How could they possibly cook in here without being smothered to death?" asked Harry.

"The cavern seems to be large enough to take care of all the smoke," was the Professor's reply.

"Well, I don't understand why they should have taken the trouble to come in such a long distance, when they would be just as safe nearer the mouth?"

"Before we leave this place we may be able to answer your two questions in a way that will surprise, if not startle, you," was the Professor's answer.

This vague reply did not detract any from the interest which the boys took in the search.

CHAPTER VII

THE TREASURES OF THE CAVE

While Harry was in the act of drawing back one of the couches, an object behind it seemed to fall apart with a jingling sound.

"What was that?" exclaimed George.

"I think we have found something here that will make us do some thinking," answered Harry, as he bent down to take up some of the detached pieces which came from what now appeared to be a large chest. He picked up one of the round pieces. "Gold, gold; look at it!"

"I suspected something of the kind when I saw the skeletons. Carefully, boys; let us remove this piece of furniture. Undoubtedly, we are in pirates' lair, and here is the booty."

The boys were too much overcome for words. They looked at the gold, and then at each other. George arose and walked back and forth. Harry, with the coin in his hand, brushed it and held it close to the light.

"With this we can buy anything we want," George finally uttered.

"Whom will you buy it from?" was Harry reply. The Professor only smiled. Of what use was money to them? George had forgotten that.

"Here is another one."

"Another what?"

"A chest, something like yours." The lid, with its mocking lock, opened easily, and there, coated

with the universal carbonate, were a mass of coins, articles of ornament, rings, bracelets, and pieces the names or uses of which were entirely unknown to them.

"Now that we have them, what shall be done with the treasures?"

The boys did not answer for some time. Here was wealth; more, probably, than either had ever dreamed of; but it was of no earthly use to them. They must, of course, preserve it. They had discovered it, and under all the laws were entitled to possession.

"Well, have we gotten together all the gold and silver and precious stones? Just imagine us as buccaneers! Owners of an island we haven't conquered, and possessors of a fortune without working for it!" and the Professor laughed at the thought of it. The boys, too, laughed, but when they looked over at the ghastly skeletons, the joy was suddenly checked.

The Professor saw the reason. "Isn't this a sermon? You have become acquainted with it early in life; some learn it very late, and others never get the lesson. Riches; death! Possessors of every material thing that earth can give, and the grave beyond it! The unfortunates there had all this, but their skeletons have stood guard over it for a century or more."

The Professor still smiled, but the boys were very grave. It was, indeed, an impressive lesson.

"Why are you so quiet? Are you mourning for them?" Then, without waiting for more gloomy feelings, he continued: "How high above the mouth of the cave do you think we are?"

This sudden change in the tone of the Professor

was almost startling to them. How indifferent! It appeared almost like desecration.

"I have no idea," was Harry's faltering reply. He looked around to assure himself that it was not all a dream. The sudden acquisition of what appeared to be an immense store of wealth, the ghastly relics below, seemed to stun him.

"Have you a reason for wanting to know how high up we are?" asked George when he had partially recovered.

"You wanted to know a little while ago how the smoke in the cavern might affect them. Haven't you noticed a perceptible movement in the atmosphere since we entered the chamber?"

The boys started and stared at him. Could it be that the cave had an outlet in the hills?

"Was that the reason you suggested we should make a circuit around the chamber after we entered it?"

"Yes; and I know where the outlet is."

"And does that explain why the pirates made their home at this end?"

"Undoubtedly; and what will be still more interesting information is, that the opening is within sight of the cataract."

Could anything be more exciting than this information?

"I now see the reason why you always wanted to come back to the cave. Did you suspect this when we first entered the cave?"

"No; but I had an idea we should find this after we made our second trip."

"What did you see?"

"Nothing but what Harry brought to me."

"What was that?" both exclaimed, eagerly.

"The slab of carbonate which Harry brought me for the marking tablet, and on which we made the chart of the cave."

"What did you find on it?"

"If you will recall, I brought it with me. It is now in the boat." Harry dashed down to the boat and brought it back. turning it over and over on the way.

The slab referred to was about two inches thick, a foot long, and probably ten inches wide, a little irregular in formation.

"When we returned home that evening, after the trip referred to, I took the slab and transferred the chart we had made to a board. In doing so, I noticed that the lime had been chipped away from one side, but that did not cause me to make any investigation at the time.

"Some days afterwards I again took it up, and could see plainly through the carbonate what appeared to be the shadows of some characters, and it at once occurred to me that, owing to the sunlight and the comparatively dry atmosphere in which it had been kept after its removal, that the lime would turn or change its color, but the lime on this background did not change in the same degree where the characters had been placed, and when we get into the sunlight you will be able to see just what I saw."

Looking at the slab, there was nothing to indicate any characters imprinted in it.

"Where is the opening, Professor?"

"Come here; directly below where we found the first skeleton; keep the light back in the recess; there; now look to the left and see that small streak of light about ten feet from the floor."

George could restrain himself no longer, but rushed forward. As he crossed a slightly elevated obstruction, his foot caught on a spur and he pitched forward. Harry, who was following, saw him fall. George, slightly stunned, had raised himself partly as Harry came up. When Harry saw him he was arising from a nest of bones which showed the remains of two more pirates, the two skulls lying close together, directly behind the little ridge over which George had fallen.

"Here are some more of them," cried Harry, as the Professor came up. "What a fight they must have had!"

The outlet at this point was fully eight feet wide, and without the lights it was still too dark to distinguish anything. George's light had been extinguished in the fall, but Harry's lamp was still available, and all were eager now to find the outlet. Harry now led the way, and within seventy-five feet, at a pronounced angle in the throat of the cave, he recognized the first real glimmer of sunlight.

"See the steps here!" was his cry. And beyond, as plainly formed as though cut a year ago, instead of a century, were steps leading up to a contracted opening, partly hidden by shrubbery.

When Harry emerged from the opening, the first sight that met his gaze, after he had fully recovered the use of his eyes, was their home, not a thousand feet away. George brushed his way out, and he stood there, not knowing whether to run or to shout or to cry. Every emotion appealed to the boys for mastery. All previous experiences during the past year paled into insignificance in

comparison with the hour just spent in the pirates' lair.

The opening from which they left the cavern was on the side of a hill, not particularly steep, formed by projecting strata of limestone, in the clefts of which vegetation grew, and at a distance the rocks could be seen only at intervals on account of the shrubbery. No one could possibly suspect an opening into the walls anywhere along the hillside. The outlet was not more than twenty feet from the rather level ground, which sloped off toward the west and in the direction of Cataract River.

They sat there silently for a time, but evidently the Professor was not disposed to allow too much time for reflections which he knew must be gloomy to the boys' impressionable minds.

"What are you thinking about, boys? Have you had enough excitement for one day?"

George was the first to reply: "I have been thinking about what we ought to do with the gold."

"Why the gold? I have been thinking of the boat."

"Do you think we ought to leave the gold there? Isn't that of more importance than the boat?"

"I do not think so, George; we can use the boat to good advantage, but where can you utilize the gold?"

"But why would it not be a good idea to get it out and take it over to the Cataract?"

"I should advise against that very strongly."

"What are your reasons?"

"Suppose we should be attacked at the Cataract and find the home untenable; this place would be

a safe retreat, and we should, in any event, have our treasure here in safety. It has been secure for the last century or so. I think it will keep for a few months more."

"It had never occurred to me that we could use this place for such a purpose. That is a capital idea. And did you have this in mind all along, Professor?"

"Yes."

After a time, when the subjects had been fully discussed, it was decided to try to bring the boat out by the new entrance, and after making all the measurements, ample room was found for this. They returned and carried and dragged it to the opening, and after some labor it was finally pushed through the opening, and when the ropes were attached it was lowered down the hillside, and dragged to a position where it could be taken by the team.

"You should go for the team now, and I will continue the explorations until you return," and so saying, the Professor went up the hill and entered the cave, leaving one of the lights at the opening.

The boys went back to the mouth of the cave and found the team, as well as Red Angel, who had remained there, and within a half hour were back again to the land entrance. The light was still where the Professor had placed it, and the boys at once entered the passageway, and went down the steps leading to the pirates' chamber.

All the bones of the skeletons had been removed from the passageway, where George had fallen, but the other skeletons were in the same place originally seen when they discovered the remains.

The Professor was not in sight, nor did they see any glimmer of his light.

It was he, undoubtedly, who had removed the bones from the passageway, but they did not stop to notice where they were deposited. When they first came in both were busy discussing the situation, in careless tones, without any pretense at suppressing their voices, but now that the Professor was not in sight, and no evidence that he was anywhere near, the scene about them began to be most weird and uncanny. They spoke in undertones, and when Harry suggested that they might call the Professor, and thus let him know of their return, it was some time before George would consent.

It became evident, as he did not appear, that something must be done, and Harry shouted loudly, and his voice reechoed through the cavern and came back to them from every quarter. In a few moments they were overjoyed to see the glimmer of a light directly to the east, which was in the opposite portion of the chamber, where, as his light moved forward, plainly showed another recess, or, probably, an opening similar to the one through which they had entered from the west side of the hill.

"Have you been waiting long?" was his inquiry.

"No; we came in less than ten minutes ago. Have you found anything new?"

"Nothing new, but many additional things; but we must take another day for this."

This was said so significantly that they looked at each other, debating in their minds whether or not the question should be pursued any further.

"Haven't you had enough for one day?" and he

said this with such a jovial mien that it restored their composure and satisfied them that another day would bring the answer that they craved.

As they passed out George turned to the Professor and asked:

"Why did you remove the remains in the passageway?"

"Because I thought it might be well to examine them at our leisure, and therefore enable us, if possible, to learn something of their history. I have put them near the steps close to the entrance."

As they passed out he requested Harry to bring up the boards from the boat, as well as some ropes and part of the canvas, which was usually carried with them to be used as a means for signaling. The bones were arranged on the boards, and kept separate from each other; after which the canvas was severed and tied around the two human frames, to keep them in place, and deposited in the boat, after it had been loaded in the wagon.

It was now past two o'clock, and none of them felt any hunger until they neared home. The trip had occupied over four hours, and hungry as they were, the reaction, after the stirring events of the day, was so marked that it was difficult to rouse them sufficiently to prepare the meal.

Somehow, the work at the factory, the building of the boat, and the care of the stock did not interest them the following day. They went around like people in dreams. Their thoughts were centered in the cavern on the hill, and many, many times during the day their eyes involuntarily turned that way. Was it unnatural that such should be the case? When, if ever, in the history

of human kind had such treasure been bestowed where the gift had been so lightly considered that they did not even stop long enough to count its value? It seemed such an unnatural thing to do, and yet the only feeling was one of curiosity.

During the entire day the boys rarely spoke to the Professor about the events of the previous day. He was busy in the laboratory with the two skeletons, and remained secluded.

"What do you think the Professor found in the cave while we were getting the team?"

"I have had a curiosity to know, as well as yourself. Shall we ask him?"

"I do not think it would be well to do so. You know he is always willing and anxious to be of service to us and to answer every question; it looks like an imposition to insist on what he evidently wishes to avoid."

"That is the feeling I have had. I love him because he has been so unselfish, and during the time we have been associated, I do not remember ever having heard him utter an unkind word."

"I have often thought I wish we knew of some way to make him understand how we appreciate him and his noble ways. You remember the birthday party we had for him? That touched him, as it did us, and it was the only time I ever saw him confused or in tears."

"I wish we knew his history. Did you ever hear him say a word about his friends or relatives? What affects me most is, that when any subject comes up, he always considers it from the standpoint of service to us. He never considers himself."

CHAPTER VIII

REMOVING THE VESSELS FROM THE CAVERNS

THE boat was finally completed, and the boys were very anxious to have a sail in it to know how it would act. The utmost care had been taken to have it well caulked, and it was again put into the water, after all the leaky spots had been closed up.

For the purpose of the test it was decided to put aboard a load of stone, of a weight equal to what their contemplated load would be, and this they estimated, not counting their combined weight, at six hundred pounds. This would be ample for all purposes.

The day selected was bright, with a fair wind. By agreement Harry was selected as the skipper, as he knew every part of the boat. It devolved on him to take command for the day, but he would not consent to be the permanent captain, as he thought that a duty which devolved on the others as well.

Angel was invited, you may be sure, and he enjoyed the idea of a sail when he recollected, as was no doubt the case, his former trip. There was evidence of the remembrance in the animal, when they saw him at the boat, on more than one occasion, swinging back and forth on the rigging.

The Professor was in his element in the boat. It was a glorious journey for him, and the boys knew it was appreciated on his part. The wind was blowing from the west, so the sails were tacked

and an easy sail made for the mouth of the Cataract.

Outside the sea was rolling, but not disagreeably so; but a much stronger breeze sprang up toward midday, and before two o'clock it was very brisk. The cliffs were rounded, and as the wind had not changed quarters, the sails were set for a southern course. This brought them around the bay and toward the headland to the east of the mouth of South River.

That region had always possessed a fascination for George and an attraction for the Professor as well. George, particularly, was anxious to penetrate the river, and sail up to the falls, but Harry's more practical views prevailed. "If we want to explore the river we can do it any day with a wagon, or on foot; but while we have the ship out, why not take a sail down the coast toward the mountains?"

The Professor concurred in this as the most liable to give them the best results, as they were out for the purpose of making tests of the craft on the open sea.

After sailing for an hour along the coast to the south, the shore line turned to a southwesterly direction, and the mountain range was now clearly perceptible, extending southwest, and along which it appeared that the coast followed. The wind changed and came from the mountains, and made progress slow. There was also a decided change in the temperature, and by four o'clock it was impossible to follow the coast except by constant tacking.

The boat was turned to the north, and with the

strong wind, which had now perceptibly increased, began to make good time. As evening approached, the wind increased, until it blew with considerable violence, every minute being more boisterous, and the Professor suggested that the jib be taken down, which was done; but the increasing gale, and the terrible strain on the mast and sail, made the boys look inquiringly at the Professor, for a word of warning.

He sat there grimly during the raging storm, and with the halliards gradually let down the mainsail when the tempest had reached such a point that it appeared to sweep everything from the boat.

Where was Angel during all this uproar? Forward in the housed portion of the boat, curled up in a corner, and apparently unconscious, the little creature did not seem at all perturbed.

"Don't you think he is seasick?"

"It is not likely. Seasickness is akin, you know, to that dizzy feeling some people have when at a height. The natural instincts of the animal prevent him from having any feeling of discomfort at a height. The trees are their homes, and for that reason they can swing from branch to branch and sway back and forth in the loftiest trees without an uncomfortable feeling."

The heavy blow continued until they had reached the cliffs, when it abated somewhat, and the boys anxiously inquired whether it would be safe to make the entrance to the river during the gale.

"We are out for the purpose of testing the boat. To make an attempt to round the cliff and steer

it into the mouth of the river in this wind will be the best test of its maneuvering ability."

As stated, the wind was now blowing from the southwest, and they were northeast of the mouth of the stream they wished to enter. They stood out to sea in order to make a starboard tack, and it was a gratification to see the magnificent manner in which the vessel responded, and before six o'clock they found themselves sailing up the river, and safely landed at the boathouse.

An examination showed that the crossbeam supporting the mainmast was split from end to end, and only the roof structure held it in place. Thus the trip had a warning lesson for them, and Harry was not slow to take advantage of it and install a larger crosspiece.

George had entirely forgotten the incident of the calcareous slab which had on it the tracings of the cave, and which had been the means of giving the Professor the first hint that they were in a pirate's cave.

The first thing in the morning he went over to the laboratory, and called attention to the slab. "Here it is," said the Professor. "You will note that the light shows some characters which can readily be made out, and at the corner here, where a portion has been chipped away, it has the appearance of something else besides calcium."

"Why, it looks like wood."

"That is what it is. I should not have noticed the wood if the peculiar lettering had not shown up through the coating."

"What are the letters, and do you know what they stand for?"

"We had better not pass judgment on that until we have removed all the calcium."

At this moment Harry came in to view the slab. It was the slab he had carelessly picked up in the cave, and therefore it had a great fascination for him. The calcium was carefully chipped off, and it was found to be a piece of oak board, with a smooth cut-off end, parallel sides, nine inches wide, nearly two inches thick, and about eleven inches long, the opposite end having the appearance of being broken. The only letters which could be

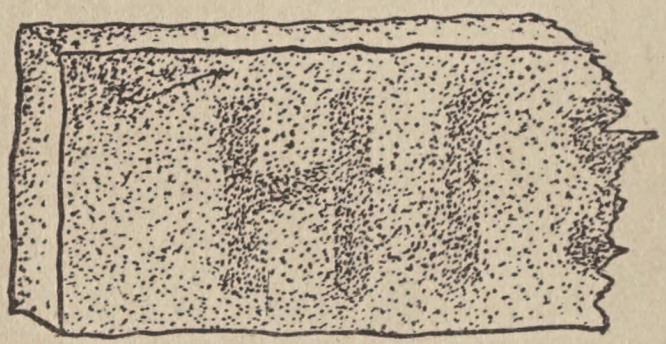


Fig. 14.

THE SLAB FOUND IN THE CAVE

made out were "HI," and a portion of another letter which could not be determined.

"What do you think the letters were intended to indicate?"

"They might be the name of a ship, or some sign. I do not think it was part of a ship. I tried to find something in the cave, on the day I went in while you went after the team, which would afford some clue, but so far nothing confirms me in any view which I may have."

"Isn't it curious that these letters should show through only after the slab was exposed to the light?"

"Why is that any more curious than photography is?"

"Because in photography something is put on the glass or the sheet that the negatives are made of, and it turns and makes a mark under certain conditions."

"Well, here is something put on this slab that turns also. Photography is a wonderful thing. Dr. Draper, the first great photographer, and who was also a scientist, says that every wall, or other object, which you stand before, has your photograph imprinted on it. The only question is to find some chemical which will develop the picture."

"What is meant by developing the picture?"

"You remember some time ago we talked about reagents, and the properties of certain chemicals to act on others, and in doing so, to make a change. Sometimes the change is a complete one, and makes a new product; in other cases the result is a complete change of color. Now, in photography, if a certain chemical is placed on a glass or a film, and the film is exposed, the light and dark portions of the object show on the film. The sunlight, or the actinic rays in the sunlight, affect the chemical material so that when the fixing chemical is applied it prevents a change in the condition of the chemical."

"What do you mean by the actinic ray?"

"All light is vibration; the greatest motions which are perceptible to the eye, being known as violet. Now there are still more rapid vibrations than are put forth to make the violet rays, which

are called the actinic rays, and are the ones which affect the chemicals so acutely."

"Is it then possible to photograph with a light that is not perceptible to the eye?"

"You have heard of the x-rays, no doubt; they are the actinic or ultra violet, which are above the visible light. These light vibrations are of such a character that they penetrate many substances. A curious effect of this was shown some time ago when a photograph was taken of the side of a vessel which had several coats of paint over the old name, and the photograph showed not only the new name, but also the old one beneath."

The time had now arrived when they must make preparations for the proposed voyage of discovery around the island. It was a momentous time for them. The boys could not help but look with longing eyes to the cave. Before they went it was felt something more should be learned about its mysteries.

The Professor was not at all backward in encouraging this feeling.

"Wouldn't it be a good thing to take such things out of the cave as we can make use of here, and during our trip?" said Harry.

"What things do you think we could utilize?"

"Probably the guns; and then they have some cooking utensils."

"And why," suggested George, laughingly, "couldn't we take some of the money along?"

"That would be a comfortable feeling to have plenty of money in our pockets. Very well, we'll take this afternoon for the trip."

An early start was made, the lamps carefully

trimmed and the guns, together with the bolos, collected. It was a short walk to the opening, and Angel, although not invited, accompanied the party.

Together they descended, and soon reached the scene of the conflict at the large recess to the left of the entrance. The Professor, after reviewing the scene, suggested that the bones should be carefully gathered together and deposited at a place where they could be buried.

Portugese Coin, 1700. *Spanish Pistole* *Peruvian Dollar.*

Fig. 15. Old Coins found in Cave.

"We do not want them here as evidences of the strife."

After all had been gathered and carried to the spot selected, the first task was to gather the treasure found in the chests. And here a sight met their eyes which staggered them. One of the chests which Harry first found contained not only an immense quantity of gold coin, of Spanish and other mintages, but curious other pieces, all ancient, as shown by the inscriptions, and long yellow bars, the last of which attracted George's attention.

"What are these bars?"

"They are gold bullion, made by melting up various articles, and probably the coin itself, so as to make it convenient for transportation."

"My! how heavy they are! and look at the number!"

When all had been assorted the Professor suggested that as they had plenty of copper utensils, the latter might be used as receptacles for the gold. The other chest contained but little coin, but here the interest was not less pronounced than in the other chest, because the vessels found were not only of beautiful, but many of curious, design. Some were of silver, as well, and the boys knew that those would be serviceable for their table, and at their suggestion all such were laid aside to be removed to the Cataract.

The kitchen utensils afforded a more varied collection than had been anticipated. Six of the larger copper vessels were required to hold the money, jewelry and other articles taken from the two decayed chests, and there were still remaining at least a dozen more smaller jars and pots, some with handles, which would be exceedingly useful in their kitchen.

All these were carefully put aside, and the smaller silver articles deposited in them. And now the guns! Seven skeletons were found, two of which had been removed to the Cataract by the Professor. After all the guns had been collected, twelve were counted.

"I suppose each fellow had two of them," was Harry's conclusion.

"If you will go over into the chamber to the

east you will find a sufficient number to assure you that they were not lacking firearms."

The boys now understood. He had told them on the second day's exploration that he did not find anything new, but only something more. Why not go and see it now. But they were restrained. A dozen guns were certainly enough. These were also set aside, and it was then agreed to place the vessels containing the treasure in a secluded nook, in the extreme corner of the large recess. Samples of the clothing, some of the knives or daggers, as well as the little trinkets, found near each of the bodies, were deposited in the receptacles that had been selected for removal.

All this accumulation of material was more than they had bargained for when they left the Cataract, so that the failure to bring the team was keenly felt. However, it was the work of an hour, only, to get the team, and it was a pretty fair load which went from the pirates' haunts to the home on the river.

George's curiosity could not keep him from taking some of the coins which he exhibited when they returned, and which they would have ample leisure to examine.

Harry's thoughts were turned to the firearms. They were certainly of an antiquated pattern. The first thing was their length. Two of them were unusually long, fully six and a half feet.

"I wonder why it was they made their guns so long?" he inquired.

"The reason was, probably, that the quality of powder was so bad that the bullet would get out before all the powder was consumed. All the an-

cient pistols were very inefficient, because of the short barrel. Even down to the time of the American Revolution the guns on board of war vessels were not capable of throwing shot very far, and the most effective ones were those with long barrels."

"In what respect is the powder of to-day more powerful than in olden times?"

"Particularly in the fact that formulas have been devised which make a higher expansion, or give a greater volume of gas. The other feature of value is, that chemical means have been discovered whereby the moment a sufficient amount of heat has developed in the powder it instantly burns—not a slow fusing, like the old powders—but the combustion is instantaneous. These two factors working together have greatly improved even the black powders."

After their return the interest in the articles was so great, and the inventory took so much time, that the disappearance of Angel had been entirely forgotten. All remembered him going along, and no one had seen him enter the cave. None of them believed he could be induced to go in, hence no particular notice was taken of his movements.

An hour after the return, Harry saw Angel coming over the field at the east of the Cataract, dragging something after him laboriously. All stood and watched him as he neared home. He had a stick, apparently, but it seemed to be unusually heavy.

George ran out to assist him, and when he came up he gravely handed to article to George. It was the barrel of a gun, with part of the flintlock still

attached, but it was rusted almost beyond recognition, the bore completely filled with dirt, accumulation and rust.

"Where do you suppose the little rascal found this?"

The Professor examined it. "Outside of the cave, undoubtedly. The curious part about it is, that this weapon is of an entirely different and more modern pattern than those we have samples of."

Harry took the gun and ran in to where the others were deposited, and true enough, it was not only shorter, but it had a smaller bore, and what is more, the outside of the barrel was octagonal, whereas the barrels of those inside of the cave were all round.

As the Professor predicted, the guns which they recovered were too much rusted to be of any service, and furthermore, they were made of iron, very much softer than the steel of which their own guns were constructed, and it is questionable whether they would be able to withstand a charge of the comparatively high power powder which had been made for the modern guns.

As curiosities the weapons were good things to have; otherwise they were of no value. This was not so with the vessels, which could be and were utilized in the kitchen and in that capacity were of the highest use. The table was supplied with articles of the purest silver, and it had a royal look.

CHAPTER IX

MAKING ELECTRICITY

In order that you may get some sort of idea concerning the condition of our little colony, at this time, it would be well to give a brief review of the situation. When they landed on the island the year before, with nothing but the clothing they wore, the prospect of being delivered was not a flattering one, as day after day passed by.

Here were two boys, unused to the privations of life, with youth and vigor, cut off from all the pleasures of manhood, surrounded by dangers, and day after day having mysteries thrust upon them which only increased their fears. These things necessarily must have produced an impression much deeper than would be the case with hardened men.

In the effort to discover, produce and build the various tools, weapons, and articles of clothing, to hunt food, and in the endeavor to learn about the condition of the island, and guard themselves against foes which might be all about them, imposed immense responsibilities.

In their struggles were personified the contests of the human race from the beginning of the world, in the effort to conquer nature, and to make it contribute to their necessities.

The Professor knew how such a condition would tend to make active minds either productive of good, or to fly out in the opposite direction and

cultivate the low and sordid instincts. Occupation, work, the utilization of the mind, and above all, to direct their energies into useful channels, had been the Professor's one absorbing aim.

The boys had responded, as all boys will, not for the love of gain or for power or glory. Our boys had none of these. Other boys do not need them any more than those on Wonder Island. What they do need is a true stimulus for work; and when that evening they were gathered together in the cozy little living room at the Cataract, the Professor who for two days had been particularly reticent and retired, said:

"Can you imagine the condition of the pirates who gathered all that hoard in the cave? What do you think their aim was in life?"

"It seems to me," was Harry's reply, "that the only thing they were after was wealth."

"If what we see in the cave is any indication, the principal thing they lived for was to kill somebody," was George's conclusion.

The answers made him smile. "You have, I presume, answered the question in the two sentences. But there is something that you haven't mentioned, which is at the bottom of it all."

"Yes; wanting to kill to get the money."

"That only states your previous answers in a more concrete way. There is one word which describes it accurately: Selfishness. When a man inquires into the secrets of nature; when he tries to turn the knowledge gained into account, either for money or glory; when he consistently devotes his days to labor, and his nights to thoughts to find out how he may do something better, or

quicker, or cheaper, it might all be denominated selfishness, and so it is, in a way. It is a selfishness, however, that does no injury to a fellowman. That kind of selfishness is the great quality which has produced the wonderful things that we see all about us, and which distinguishes the man from the brute creation."

"But I have read of a great many men who made millions and millions and who never did any of the things you have just referred to," answered Harry.

"Then do you think they are any better than the pirates were?"

Notwithstanding the exciting times, food was a necessity, and it had to be found and prepared. It could not be bought. All the gold in the cave would not purchase a single meal. More barley had to be ground and the stock of honey was almost exhausted. Their duties in the shop, consequent on the haste exhibited to get the boat and weapons ready, contributed to the low state of supplies.

George announced that there was less than two pounds of the honey left, and proposed that a trip be taken to the flats, where the Professor had found the sugar cane. All joined in the journey to the cane field, and Angel was invited to join, which invitation was accepted by him gleefully.

The bolos were taken for the purpose of cutting the cane, and on the way George's inevitable question point was in evidence. "What did people use for sweetening purposes before cane was discovered?"

"Honey was the principal source of the world's

sweets. But cane is not the only kind of vegetable from which the principle has been extracted. There are many kinds of reeds which furnish a sweetish substance. Sugar cane was first made known in eastern Europe by the conquest of Alexander the Great. Nearchus, one of his admirals, in sailing down the Indus, found the reed, and it was, previous to that time, known throughout the greater part of India. He described it as a kind of honey growing in canes and reeds. From this you may infer that honey was the principal source of sweets in his time."

"What are the other principal plants or substances that sugar is made from?"

"Mainly from beet, tubers of various kinds, such as the common dahlias, and numerous vegetables, from milk, fruit, gum arabic, as well as fish."

"I have heard it said that sugar contains all that is necessary to sustain life. Is that true?"

"That is a mistaken idea. It will sustain life for quite a time and with the addition of nitrogenous matter has great fattening properties, but without that it is not valuable as food."

"What do you mean by nitrogenous matter?"

"Meat, fish, eggs, milk, beans, peas, and the like, all contain a large amount of nitrogen."

"I remember my arm being burned on one occasion, and mother made a syrup out of sugar and put it on. In what way was the sugar beneficial?"

"In the first place, sugar is one of the most powerful antiseptics known. It acts, therefore, as an aid to healing, since it protects the wound from foreign substances and from poisonous and harm-

ful germs. In the next place, it is a great preservative for either fruit or flesh."

The cane was cut close to the root, and the top and leaves trimmed off. Within several hours a full load was thus procured. The boys enjoyed the pith, and George playfully gave some to Angel. His surprise knew no bounds. When he

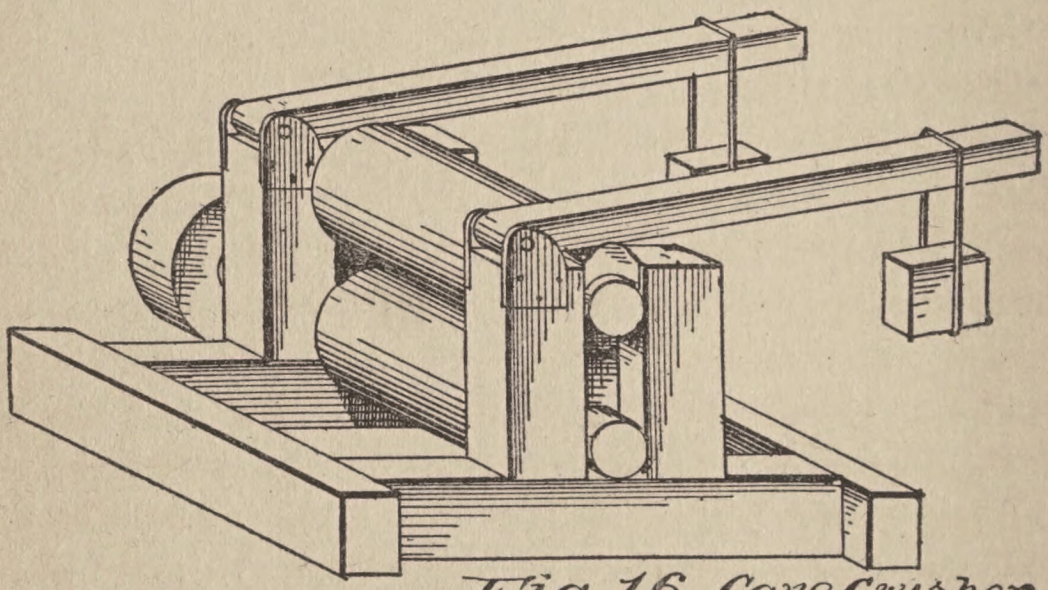


Fig. 16. Cane Crusher.

knew what the cane was good for, he simply gorged on it.

Harry at once set to work on turning up two rollers from hickory, the rollers being eight inches in diameter, and eighteen inches long, and each being provided with a spindle four inches in diameter. One end of each of the spindles was longer than the other, so pulleys could be attached, the object being to provide a means whereby they might be turned by suitable belts from the water wheel. In addition, the top roller was made so it would yield, and had levers resting on the spindles, and provided with weights, so the rollers would press

out the juice, whatever the quantity that might be placed between the rollers.

It was really a simple little machine to put up, but it required a day for both of them. Vessels were now provided for the juice, and when they were filled, the Professor suggested that a little lime should be put into the juice, after it had been strained through the ramie cloth.

"What is the object of putting in lime?"

"To precipitate the impurities."

The action of the lime was plainly visible, and after it had been allowed to settle, the clarified portion was drawn off, and the process of boiling down was proceeded with. As fast as one of the vessels was boiled down, more of the cane was crushed, the juice being dipped from one vessel to the second one, until the entire load was crushed and the juice boiled down to a thick consistency.

Here was molasses, at any rate a good substitute for honey, and it was so homelike to get the real article. That night they had molasses candy. It felt like old times. It was a real candy pulling, and no one enjoyed it more than Angel. From the moment he had the first taste of the pulp of the cane, he was the most interested one of the party. But the fun came the next morning, when George brought out, for his benefit, some of the taffy which had been set out to harden. The chuckle which he emitted, when he tried to pry off a piece of the sweet morsel, was too amusing for words.

When the entire amount of juice had been boiled down and it had reached the point where it had the appearance of granulating, the fire was withdrawn, and the whole mass stirred until it was

cooled, and the result was a fine sample of beautiful brown sugar which weighed forty-three pounds.

Nevertheless food was an important item in their preparations, the necessities for doing everything in their power to insure the success of the maritime enterprise. One of the most valuable adjuncts for sailing is a compass. No attempt had been made to produce the implement, and when the needs of the expedition were being discussed, Harry was curious to know the reason why the compass always pointed north and south.

The Professor was very much interested in all electrical phenomena and replied: "The earth is

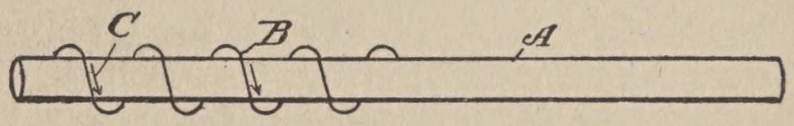


Fig. 17.

A Magnet

a huge magnet, and any body which is magnetized has a north and a south pole. The needle which is also a magnetized body has, in like manner, a north and a south pole."

"But in what manner does that make the needle point in one way only?"

"Electricity is a very curious thing. While the current unquestionably moves from one end to the other of a conductor, it also exhibits itself in the form of rings around the wire. This may not be understood in the absence of a sketch. For that purpose I make a drawing (Fig. 17) which shows a conductor (A), through which a current is passing, and this current is represented by the spiral line (B) which goes around the conductor."

"Well, is magnetism the same as electricity?"

"Both exhibit the same manifestations. Magnetism is nothing more than a body charged with electricity. The electricity, which appears to travel around the conductor (A), extends out for some distance from its body, and produces what is called a magnetic field. This is the case whether the magnet is a permanent one, like the earth, or whether the conductor is charged by a dynamo."

"What is the difference between the north and the south pole?"

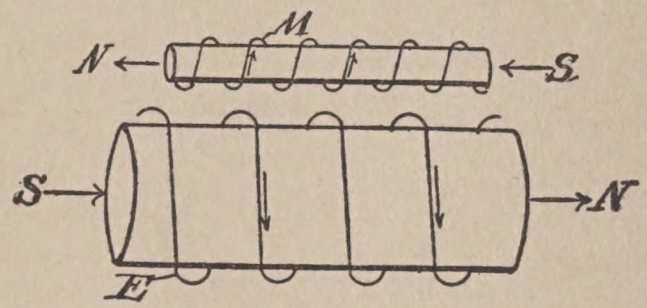


Fig. 18.

MAGNETIC INDUCTION

"There is really no difference. The terms north or south and positive or negative are mere relative designations, and are distinguished simply by the movement or direction of the travel of the current. You will remember when we made the battery, it was shown that the current, outside of the battery, moved from the positive to the negative pole. That was merely stating that it moved from the north to the south pole outside of the earth, and from the south to the north pole inside of the earth. The current is, therefore, from one magnetic pole to the other."

"What I cannot understand is why the magnetic poles should be at the north pole and at the south pole."

"The magnetic poles are not at the poles of the rotation of the earth, but hundreds of miles away, to one side of the poles on which the earth rotates; but they are near enough to the real poles, for all purposes, so that the needle points to what we call the north pole of the earth. Any magnetized body must have these two opposite poles. If it is a body, like a bar of iron, one end is called north and the other south. Look at this other sketch (Fig. 18) and you will see how the currents flow in the two magnets. In this case the large body (E) represents the earth and the small body (M) the magnet. Now notice that the current going around the large body moves to the right, or to the north pole, whereas the current in the small magnet (M) flows in the opposite direction."

"And does the current flowing around the bars, as you have shown, make the small magnet turn around so that it is always parallel with the large magnet, and make the north pole of one magnet at the same end with the south pole of the other magnet?"

"Yes; to make it still clearer, I make two more drawings (Figs. 19 and 19*a*), in which two sets of magnets are shown. In the first of these pairs of magnets (Fig. 19), the two north poles approach each other, and the two south poles are opposite each other. The currents, if you will notice, at the north poles move toward each other, and at the south poles move away from each other. They are, therefore, acting against each other, and the result will be that the magnets will move away from each other. If, now, one

of the magnets is turned so the poles of one magnet approach the opposite poles of the other magnet, as shown in the second view (Fig. 19*a*), they will attract each other, because the current is permitted to flow through the two magnets in the same direction without one conflicting with the other."

"Is that the reason it is stated that likes repel and unlikes attract?"

"Yes."

In order to take advantage of this knowledge, knowing that the earth is a great permanent mag-

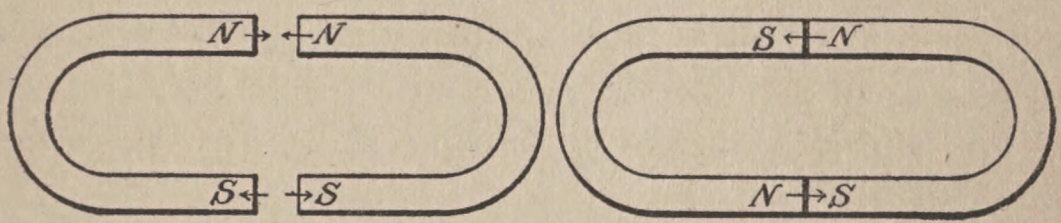


Fig. 19. *Fig. 19a*

THE TWO MAGNETS

net, it was necessary to make a small magnet, and so suspend it that it would turn freely, and the magnetic north and south could then be determined.

To do this the battery which had been previously made was brought into play. George took a hand in the work, and while they were preparing the metal for the little bar, said: "You spoke about a permanent magnet. What other kinds of magnets are there?"

"Magnets are permanent or temporary. A permanent magnet is one in which the electricity resides, or remains, as it does in the earth. A temporary magnet is one which has magnetism

imparted to it only while a current of electricity is passing around it."

"How is the current made to pass around it?"

"By wrapping an insulated wire around it, and sending a current through the wire. When that is done the same thing is done to the bar as the bar of the permanent magnet exhibits. As soon, however, as the current through the wire ceases, the bar is again demagnetized. That is, it ceases to be a magnet."

"We have the small bars ready, Professor. What is the next step?"

"It must be hardened so as to make it a flinty steel. The harder the better, so that it will preserve the magnetism imparted to it."

"Is that the better way to make the temporary magnet?"

"No; in that case the bar should be of the softest iron. Remember, therefore, that for a permanent magnet, use the hardest steel, and for a temporary one, the softest iron."

"Then as we want to make a permanent magnet, must we harden both of the bars?"

"No; for our uses, one must be left soft, because on that we shall want to wind some insulated wire to make a temporary magnet."

The small amount of wire which was on hand was then coated with a thin layer of the ramie fiber, which was carefully wrapped around, so that the different layers of wire could not touch each other. When this was completed, a spool was constructed, which fitted over the little bar or rod, because they were rounded off, and one end of the soft iron rod extended out beyond the spool.

The opposite ends of the winding were then brought out and attached to the terminal wires of the battery. A test showed that the magnet thus made would readily pick up pieces of iron or steel. The Professor then took the hardened steel rod, through which a small hole had been bored, midway between its ends, and laying it down on the table, the projecting end of the temporary magnet which projected from the spool was put into contact with the hard steel rod, and slowly drawn along to the end. The soft bar magnet was then

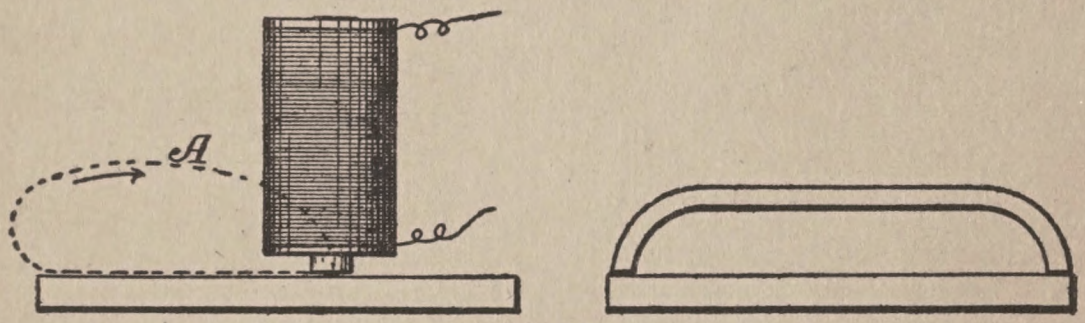


Fig. 20.

MAKING A PERMANENT MAGNET

raised up and again repeated, as shown in the drawing (Fig. 20), where the dotted line (A) represents the movement of the end of the temporary magnet.

This was repeated over and over a great many times, and finally the hard steel bar was found to have a charge of magnetism, and for the purpose of providing a means for holding the magnetism, a C-shaped piece of iron was put on the bar, as shown in the detached figure.

"Is that the reason," asked Harry, "why a small piece of metal is always put across the ends of a horseshoe magnet when it is not in use?"

"Yes."

CHAPTER X

STARTING ON THE VOYAGE TO THE WEST

"If I remember correctly, you stated some time ago, Professor, that the barometer indicated the pressure of the atmosphere, and in that way it was useful in letting us know what the weather would be. Before we sail, would it not be well to make one of them? If we had possession of one of the articles, we might not have been caught in the storm the first time we took out No. 3."

"That is a good suggestion. I intended to propose that, because with the barometer and the compass we shall be equipped with two of the most useful instruments needed."

"I cannot comprehend how the air pressure has anything to do with the weather. Is the air pressure really greater at one time than at another?"

"Heated air ascends, does it not?"

"Yes; I can understand that."

"As it ascends it is, therefore, lighter at that point than normally. On the other hand, moist air is heavier than dry air. These two conditions would be indicated by the barometric column, would they not?"

"I presume they would; but when the air is moisture laden we don't need a barometer to tell it is going to rain. We know it and feel it. What I particularly wanted to know was how the barometer by its actions would indicate it ahead for any length of time."

"The barometer does not indicate with any degree of accuracy on land; but on sea it has a much better application. The instrument shows the present pressure of the atmosphere, and its variations correspond to atmospherical changes which have already taken place, the effects of which may follow their cause at a greater or less interval."

"Then how could it be ascertained from the instrument when there would be a storm or rain?"

"After a continuance of dry weather, if the barometer begins to fall slowly and steadily, rain will certainly ensue; but if the fine weather has been of long duration, and the mercury may fall for two or three days before any perceptible change takes place; the more time elapses before the rain comes, the longer the wet weather is likely to last."

"Then what indicates dry weather?"

"If, after a great deal of wet weather, with the barometer below its mean height, the mercury begins to rise steadily and slowly, fine weather will come, though two or three wet days may first elapse; and the fine weather will be more permanent in proportion to the length of time that passes before the perceptible change takes place."

"Is this the case at all times of the year?"

"The seasons affect the barometer, it is true. A sudden fall of the barometer in the autumn or in the spring indicates wind; in the summer or in hot weather it prognosticates a thunderstorm; in winter, after frost, a sudden fall of the mercury shows a change of wind or a thaw with rain;

but in a continued frost a rise of mercury indicates approaching snow."

"It seems, then, that a man must be pretty well versed in the weather to be able to read the signs."

"That is a correct observation. The instrument in the hands of one who has had experience with its use is absolutely necessary; it is not a very satisfying device for those who do not take the time or trouble to read all the signs, and note all the indications."

As detailed in a preceding chapter, the hardened steel rod for the compass was brought out for the purpose of securing it in a little case, so that it might be utilized to give them the true north.

It was a difficult task to find a means of suspending it, for the reason that they had no tools which would make fine and carefully pivoted balances, but eventually this was done, and they were gratified to see the little rod or bar swing around and point north and south.

The work of arranging suitable closets for the various provisions and providing a miniature kitchen was the next thing in order. This occupied several days. Instead of taking the bedding in their house, it was decided that new mattresses should be made up from the barley, of which there was quite a quantity on hand.

One of the receptacles taken from the cave was a copper jar, which held five gallons of water. A top was made for this which could be sealed up, to hold a reserve supply of water. In addition two other vessels were also provided for the regu-

lar supply, and also fitted with covers, so that they had about ten gallons, an amount which was considered sufficient.

The matter of fuel was a more difficult one to solve, unless they intended to prepare most of the food before starting; but George insisted that the small stove should be put aboard, and about fifty pounds of the coal stowed away.

"How long do you think we should provision for?" was George's inquiry, as they were carrying the various things aboard.

Harry had no ideas on the subject, but the Professor ventured the opinion that at least two weeks' supply should be arranged for.

This conclusion rather startled the boys, who had not expected more than a few days' trip, and when they questioned him about his reasons for making the statement, he said: "Did you ever hear of the old lady who attended a special meeting of prayer for rain? She came with an umbrella, and the people laughed and chided her. The minister reproved them, saying: 'She, at least, has faith, which you have not.' We are going for two purposes: one is to learn something about the island we are on, and the other to rescue our companions if they can be found. We couldn't rescue them and let them starve."

Those words impressed them as nothing theretofore had, that the Professor believed they were really going to find their former shipmates, and that they would have stirring times before them.

Nothing so stimulates the actions of men, or boys, as the prospect of adventure. Their trip

had a double meaning, and it is not venturing too much to say that their feelings were most tense during the entire period in which they were engaged at the task of fitting out the little ship.

At last the day was set for the departure. The cattle could take care of themselves. A tablet was prepared to be put up on their dwelling, stating who were the owners of the habitation, their present destination, and briefly relating the knowledge they possessed of the inhabitants of the island, a statement of the direction they had taken, and the kind of boat to which they trusted their destiny, and when they expected to return.

A copy of this was then carried to the pole on Observation Hill, and nailed to the mast, to replace the small tablet which had hitherto filled that place. They were to launch the boat for the start on the morrow.

That night a storm blew up from the west, as most of the winds had previously blown from that quarter during the past month. The storm was severe during the entire night, and abated somewhat in the forenoon, but it again increased in fury before noon and continued with more or less vigor all that day and during the night.

"I am afraid this storm will prevent us from starting for several days, on account of its widespread character. The sea for hundreds of miles has been subject to this monsoon, and we would have a very rough time until the sea quiets down."

The delay was a bitter thing for the boys. Expectation had run high. Anticipation doesn't mildly or easily brook waiting. They did not

know what to do, or how to pass the time in the interim. It was such a new and trying condition for them.

The Professor noticed how they chafed under the restraint, but apparently took no heed of it. However, he encouraged them in every effort they made to divert themselves and to occupy their minds during the waiting period.

During one of these spells which come on all more or less during such trying hours, George could not hold in any longer, but broke out impatiently: "What is the use of waiting any longer? The storm may keep up for a week."

"Then do you think we had better venture a start under these conditions?"

George thought a while. He appreciated the risk. Harry, too, was anxious and nervous, and expressed a willingness to take the risk.

"Let me put another side to the question," said the Professor. "We are perfectly safe here. You take no risks by remaining. You have in the cave treasure that will make you millionaires. You cannot afford to take any risks. If we knew something of the conditions on the island, and had a certain knowledge that our comrades were in danger, the considerations I have named should not deter us from starting. But with all these things in the dark, and with the monsoons likely to break out again at any time, the question is whether we can afford to risk the safety of the enterprise because of impatience at delay."

"Yes," answered Harry. "I have thought of these things, and I feel that the Professor's advice should be followed."

The boys were particularly surprised that he should refer to the money in the cave as a reason why they should consider their actions in the matter. It was so unlike him to refer to any sordid considerations as a reason for not performing a great duty.

"I would also remind you that one of the greatest boons ever given to the great investigators of the world came through delays. Time is a wonderful reasoner. It is also a great modifier of events. Darwin was prevented for twenty years in promulgating his great thesis; some of the most marvelous inventions took years to bring out and develop into such a state as to make them acceptable to the world. Delays, patiently borne, make strong men. The impetuous think they represent wasted opportunities. Davy Crockett enunciated one of the greatest principles of human action when he said, 'Be sure you are right, then go ahead.' It was only another way of advising against recklessness or impatience in any enterprise."

Thus three days passed, and not without misgivings, the signal was given for the start. Angel accompanied them, and with a new flag which the days of leisure had given them an opportunity to prepare, the little craft sailed down the waters of Cataract, in a shining sun, bound for a haven which might mean rest, or to a shore which might offer no welcome to them. The wind was coming mildly from the north, and when they had cleared the shore line and were beyond the influence of the swells, their course was directed to the west. Several miles beyond was a point which projected out

to sea; they could see this plainly from Observation Hill, and during the last long trip inland they reached the sea beyond this cape.

The shore line beyond was absolutely unknown to them, but it extended to the west as far as they could see, and when night set in the faint mist prevented them from judging how much farther it ran in that direction.

Without proper instruments at sea, distance is always a difficult matter to judge, and the boys were constantly venturing guesses as to the distance traveled. The start was made shortly after nine o'clock, and it was now past six in the evening.

"How far do you think we have gone during the day?" was George's question.

The Professor made a mental calculation before replying. "If we have traveled at the same speed during the entire course that we made during the first three miles to the cape, we have gone about thirty miles."

"Do you know it is three miles to the cape?"

"Yes, it is approximately that distance. I measured it by triangulation some time ago, using our house and Observation Hill as the base line."

The boys had neglected to take this precaution.

"What was your object in doing that?"

"So that we might have some means to observe the speed our boat could make. If we knew the speed of the wind, we might be able to calculate our distance."

"But the wind has been coming from the north and we are sailing due west. Would not the dif-

ference in the speed of the wind make a difference in the speed of the boat?"

"It was for that reason I stated if our rate of travel was the same we would have made that distance. The wind has been variable at different points along the coast, so that our average may have been four miles per hour."

"At what speed has the wind been during the day; I mean the average speed?"

"Less than eight miles an hour?"

"If the wind had been coming from the east we could have made much better time, and we might then have been near the mouth of the West River," was Harry's conclusion.

"Why do you think we should have made better time?" asked the Professor.

"Because we should then have been going with the wind."

"You are entirely wrong in your assumption. Sailing ships travel faster when tacking than when sailing with the wind."

The boys looked at the Professor in astonishment.

"It does not seem possible," replied George, "that any movement of the wind pushing sidewise could be more effective than a pressure straight ahead. Can you explain the reason for the statement?"

"When the wind blows straight against a sail, certain eddies are produced which cause a convolute stream around its edges. These currents are counter to the forward movement of the vessel. Assuming that this normal pressure of the wind is 1,000 pounds, it is estimated that fully

half is lost in effectiveness. On the other hand, if the ship is moving forward at right angles to the direction of the wind, and the sail is set at forty-five degrees, that is what is called a tack; while it has only about six-sevenths the surface that it had when going with the wind, the sail is

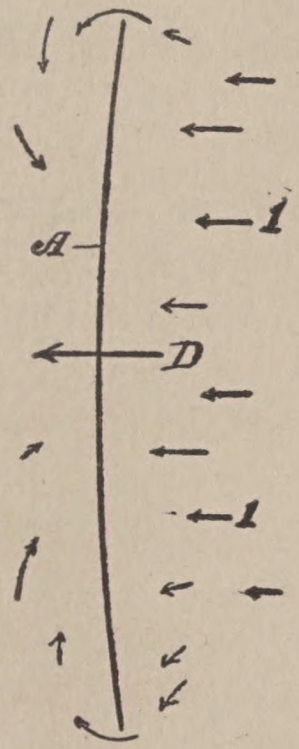


Fig. 21.

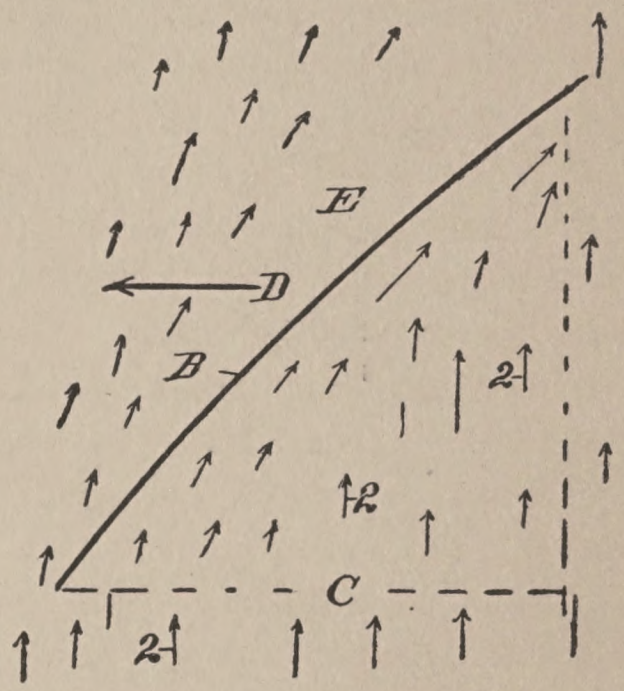


Fig. 22.

ILLUSTRATING WIND PRESSURE

constantly going into new wind and, therefore, the pressure is a constant one and most efficiently applied to the surface."

"Do you mean by this that if I hold up a sail so that the wind blows flat against it, the pressure will not be as great as if I held it at an angle?"

"No; I had reference to a moving object. I can better explain the phenomenon by illustrating the two conditions: In the drawing (Fig. 21), let A represent a sail with 100 square feet of surface. The darts (1) represent the wind blowing dead

against it. This is called the normal position. You will see the darts representing the direction of the movement of the wind. Now look at the next sketch (Fig. 22). Here the sail (B) is put at an angle of forty-five degrees from the direction of the wind. The sail is still the same size vertically, but it is somewhat smaller horizontally across the line (C), this diminution in size being about one-seventh of the entire area. The darts (D) in both cases represent the movement of the boat, and the darts (2) in the last sketch show the wind striking the sail at an angle."

"In the first sketch the darts (1) strike the sail normally, as you say; in what way do the darts (2) in the next figure strike the sail?"

"At an angle of incidence. If you will notice the behavior of the wind in the first view it will be seen that the wind curves around the edges of the sail, and strikes against the back of it, and thus produces the retarding effect I referred to. On the other hand, by examining the second sketch, the darts (2) plainly show their course across the sail diverted from their straight source, and behind the bulging sail the air does not press against the sail, but tries to continue in a straight line. As a result a partial vacuum is formed along the region designated by E, and this produces a most effective pull, since the sail constantly tries to move forward and fill this vacuum. Is this made clear to you?"

"I can plainly see now what the action of the air is, but does the air push just as hard against each square foot when it is at an angle as when it is blowing against it straight?"

"That is a good observation, and one that might

ordinarily be overlooked. No, it does not, but the difference can be readily calculated."

"Then supposing the sail to be 10 feet square, and the wind is blowing against it straight, as in the first sketch, at the rate of twenty miles an hour; what pressure would there be against the entire sail?"

"At that speed of wind the pressure on each square foot of surface is 2 pounds, and this multiplied by 100 equals 200 pounds."

"When it is at forty-five degrees, what is the pressure on each square foot?"

"This is determined in the following manner: Square the speed of the wind, which means multiplying 20 by 20, and this produces the square, 400. In mathematics, as in many of the sciences, a constant is employed. A constant is a figure which never varies. In this case the constant is designated by the decimal .005. That means 5/1000th, or reduced to its lowest denomination, 1/200th. If, now, we divide 400 by 1/200, the result will be 2 pounds. This figure thus represents the pressure of air on each square foot of surface, which, multiplied by the sail area, 100 square feet, makes 200 pounds."

"If that is the push when it is normal, what will it be at 45 degrees?"

"Each angle of incidence has its own figure, or coefficient, or for your better understanding, value, and the value at 45 degrees is .666. So that by multiplying 200 by this value, we get a total pressure of 133.2 pounds."

"These figures are used a great deal in flying machines; are they not?"

"Yes; and that is a subject which we might pursue, but there are some things right ahead that may for the present interest us more."

Through the haze which had now settled down, a faint outline of land was made out in the distance. The course was altered to the northeast, and after a quarter-hour sail, land was again espied ahead, so that to avoid the shore the course was taken due north. This was evidence that the land projected northwardly, and the Professor suggested that the effort should be made to chart as accurately as possible the shore line. This could be done mentally.

"I had forgotten to take any note," said Harry. "What is the proper thing to observe in making these calculations?"

"Two things must always be uppermost in the mind of the explorer on the sea: First the time, and second the speed. Time can always be accurately determined, but the question of speed can come by experience only. A good sailor can very accurately determine speed by an examination of the passing water, where the sea is comparatively calm. I have known where the distances have been thus estimated within a hundred feet in each mile in a ten-mile course, and where the speeds were varied along the route. Then, a good observer must have the gift of direction. If he has sailed one hour at a certain speed in a given direction his mental chart may be of the greatest service to him. In our case it would be invaluable. It is a quality well worth our effort to acquire."

CHAPTER XI

A TERRIBLE VOYAGE AND THE SHIPWRECK

The shadows of night were now upon them. How vividly it recalled to their minds the horrors of the five days and nights during which they were tossed about in the little lifeboat a year before. Then they were helpless, and now strong. At that time everything was dark and gloomy, without a ray of hope. Contrast the situation at this time.

What a gratification it must have been to look back during the past twelve months and mentally calculate what they had accomplished. They had delved in many of the hidden mysteries of nature and learned the secrets. Such knowledge had been put to use. They had discovered many things that gave them pleasure, but in doing so found others that startled and grieved them. Things inexplainable and impossible to fathom had crossed their paths on almost every side.

But they were now doing the work of men. The Professor knew how they had developed, and grown brave and strong. He knew it better than the boys could realize themselves. What a source of pleasure it must have been to the kindly faced, gray-haired Professor, as he looked at his charges in admiration and love. Could anything be more inspiring than the contemplation of the work he had done?

And now the inevitable charting board was

brought out, and the plan adopted which would enable them to trace the coast line. It was explained that all sailing was by the points of the compass, and for this purpose the compass was made to correspond with the regulation instrument. This is shown in Fig. 23.

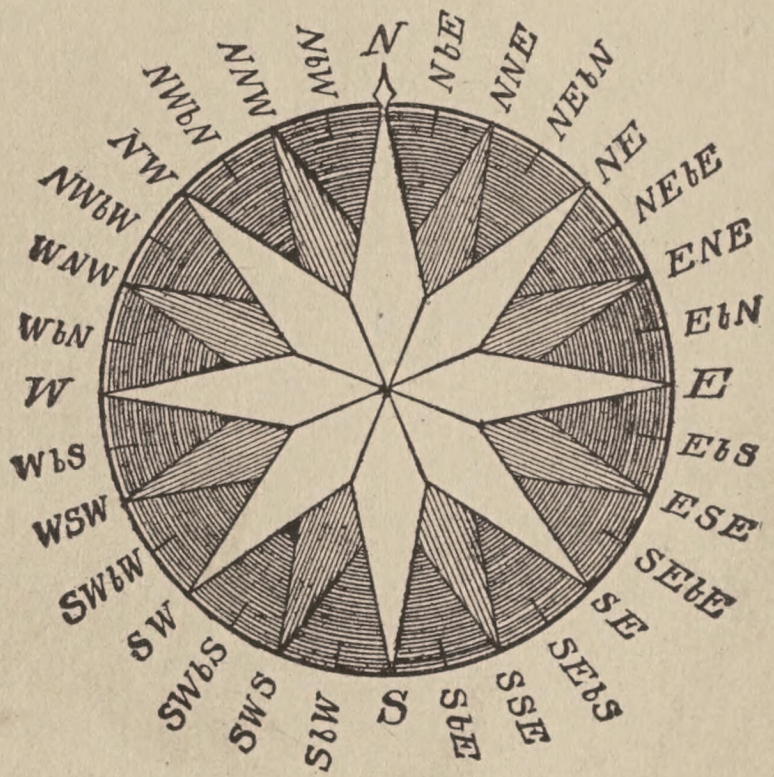


Fig. 23.

MARINER'S COMPASS

The four cardinal points are north, south, east and west. Exactly midway between each of the four points are the divisions designated northeast, southeast, southwest and northwest. Then, again, intermediate, the last divisions and the cardinal points are other markings which show that the angles are nearer one of the cardinal points than the other, so that a course may be marked off, by the compass, which, if followed for a certain time, and the speed of that period determined, can be traced and thus marked out on

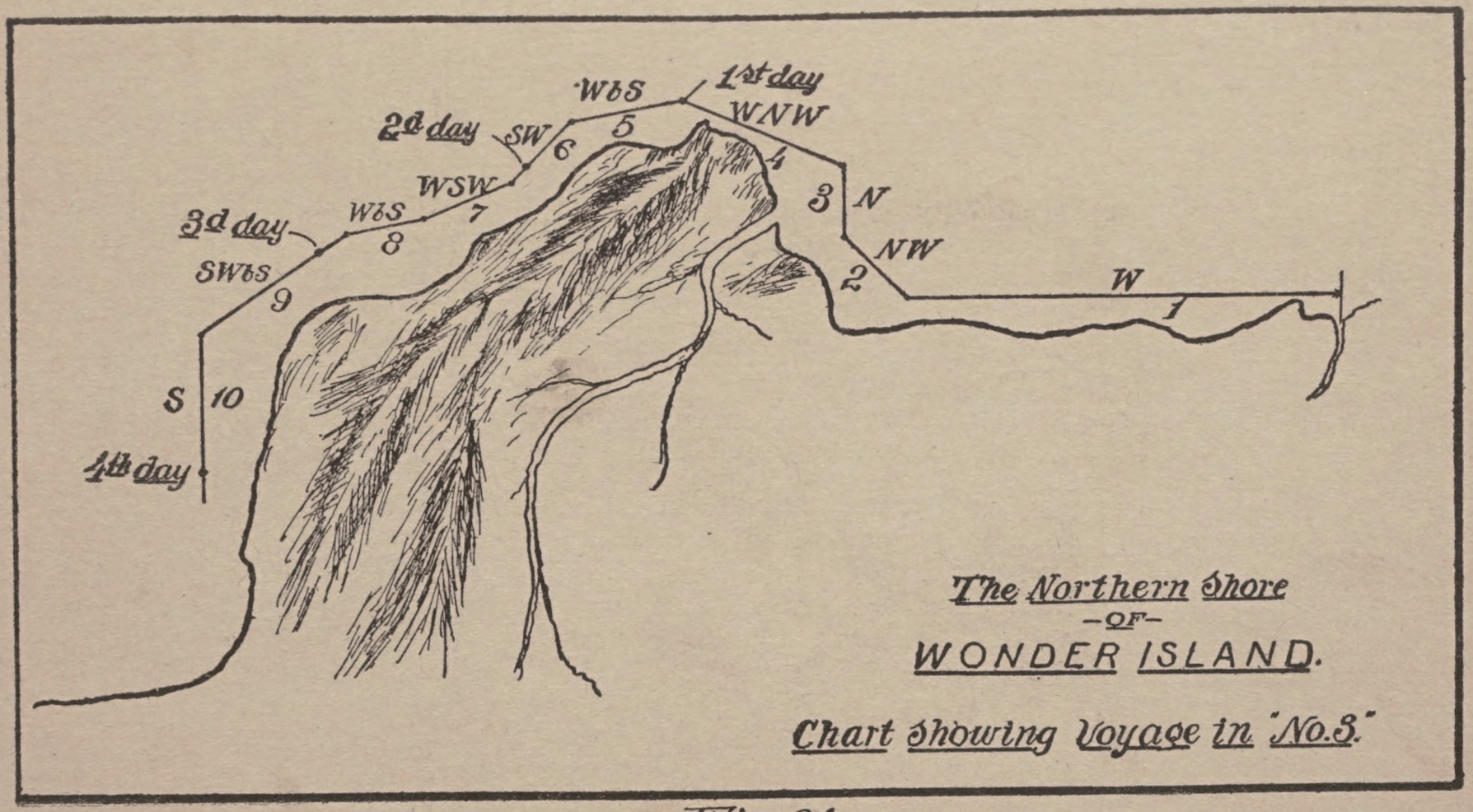

WbS
1st day
WNW
2d day
SW
WSW
3d day
WbS
SWbS
S
4th day
1
2
3
4
5
6
7
8
9
10
N
NW
W
The Northern Shore
—OF—
WONDER ISLAND.
Chart Showing Voyage in "No.3."

Fig. 24.

paper so that the outline of the coast can thereby be laid out.

The Professor had the charting board before him. "I have marked our starting point, which is designated as A. It will be remembered that we marked a course due west, passing the headland three miles from Cataract River. This is line 1. When we saw the land ahead of us last night, we changed our course by the compass to northwest, thus making a new line of travel, which

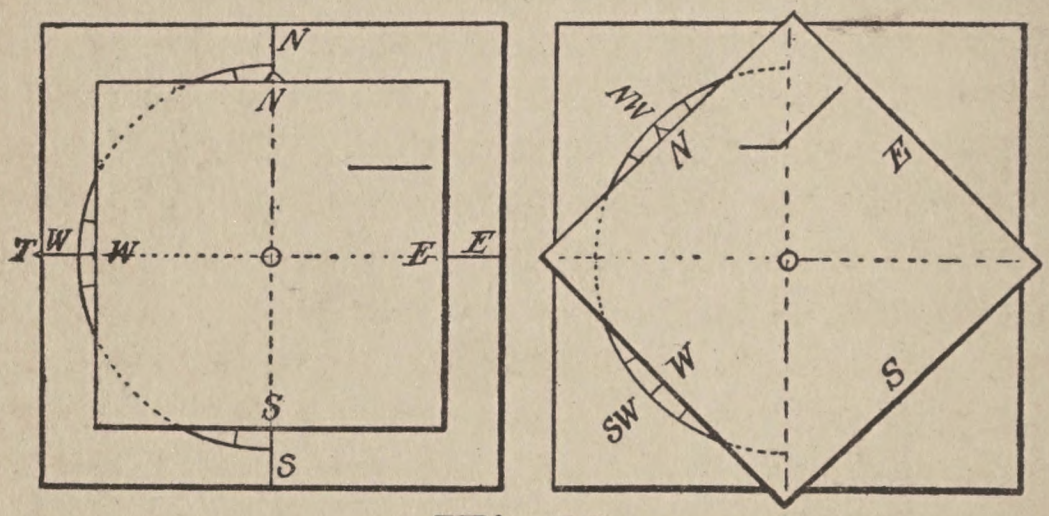


Fig. 25.

THE CHARTING BOARD

you see is designated as 2. B was the point where the turn was made."

"But in what manner did you know how to transfer it to the board?"

"The board has two lines crossing each other at right angles to correspond with the two lines on the compass. The compass was put on the middle of the board, and the upper board turned so that the needle was on a line with the N——S line."

The boys now noticed for the first time that there were two boards, one above the other, and that the lower one was a little larger, and was

attached to the boat. "Why do you have the lower board attached to the boat and larger than the upper one?"

"The lower board has on it a section of the compass, and the upper end a pointer, as you notice, and the line T represents the boat's direction, so that when the compass was placed on the upper board, the latter was turned so that it corresponded with the points of the compass. The little pointer then accurately pointed to northwest, on the lower board, and by this means the changing of the upper board, so as to keep it due east and west at all times, will enable us to keep on our course."

It was a long and weary night. One of them slept while the others were on duty. The boys knew the time on shipboard, where the day begins at midnight, and is divided into watches of four hours each, thus making three watches for the night and three for the day. A bell is struck every half hour, so that each watch is noted by the eight strokes of the bell. What is called the dog-watches occur between 4 and 8 P. M., this period being divided in the first dog-watch between 4 and 6, and the second dog-watch between 6 and 8.

"Why should such peculiar times be taken, or the periods be divided up in that way?"

"For the very reason that we discussed the arranging of our time of watch last night; namely, so that one person would not have the same watch every night. It was agreed by us that one should have three hours' uninterrupted sleep, while the others were on duty, so that each would in turn get three hours' work. Our arrangements are somewhat different from shipboard time, on ac-

count of our number, but the principle is the same."

During the night the wind changed to the north, so that progress was slow and required considerable tacking, and when the Professor came on duty he found the course still to the north, and on questioning Harry, found that the wind had been rather regular during his watch. Within a half hour of the time he took charge the western shore faded away, and the course was directed to NWW, in which direction they continued until well along in the forenoon. Then, as the land receded again, another tack was made, WbS, which means West by South.

The winds, however, were perverse during the second day. After a calm the wind veered to the west, and when in the afternoon the course was changed to SSW they had to sail close to the wind, and made slow progress.

Let us see what they found on the day's journey along the northern point which they rounded the second day of the journey. Cliffs, like their own, were distinctly visible in the evening and during the morning of the second day, but when morning broke on the third day they saw a beautiful shore line, and beyond the mountain range which was seen by them on their land trip to West River. It was now certain that the mouth of that river had been passed during the night and all regretted this.

During the whole of the third day they were forced to sail in the teeth of the wind, which necessitated frequent tacking. Not a sign of human habitation was seen on this day, but during the night, when the boys were on duty, they declared

that they had seen lights to the south. The interest was most intense. Were they really rounding the island?

The course for the opening morning of the fourth day was SWbW, and early in the day they were not more than a mile from the shore, and then the shore gradually receded, but the course was not changed. The wind began to blow with greater force, and came from the southwest. As night approached it increased, but they continued tacking, hoping that they might reach the western extremity, and thus be able to run to the east before the wind.

Before eight o'clock lights were distinctly visible. They had reached the vicinity of human habitations. The boys were too excited to think of the watches which had thus far been observed. Aside from that, the wind had now reached such a violent stage that it was impossible to make any headway against it.

A consultation was had. "We must either turn to the north or go to shore. I fear this sudden change in the direction of the wind," was the Professor's opinion of the situation. It would not be wise to risk the shore. All knew that and sadly they turned the craft to the north. It was well that they did so. Every moment, it seemed, some new impetus would be given the wind. It howled on every side of them; the waves drifted across the little ship, until everything was dripping with moisture, and the only dry spot was within the little housed enclosure which had been well protected on the open rear side, thanks to the watchful suggestions of the Professor.

To add to their discomfort of mind, the land was

not in sight. There was nothing to steer by except the compass and the chart which had been laid out. They were now going north over the course that had been traversed for the past two days—the west coast of the island.

It was a long, long night. No one slept, because fear and anxiety was ever with them. They remembered now with vividness the days spent on the ocean when they were wrecked. It was a terrible succession of hours, with the wind and the lightning and the rain one continuous orgy. The Professor sat at the tiller. The sails had been taken down long before. The impact of the driving storm against the housed structure was sufficient to drive it forward, so that the vessel could be guided.

It seemed that every blow against the boat would wrench it to atoms, but if any part had given way it was not apparent. Harry, who sat nearest the housed structure, suddenly sprang up, and pointing down, cried out: "It is leaking; look how it boils!" It was forethought on the part of the Professor to put in a supply of the oakum used for caulking purposes. Harry sprang for it, and George grasped the bailing pan. After a struggle a sufficient amount was driven into interstices to keep out at least a portion of the seepage. This knowledge was most oppressive. When a boat of this kind once springs a leak, due to a severe wrench of the shell itself, it is a difficult matter to remedy it, without structurally strengthening it.

Morning was now appearing, and still no land appeared in sight. More leaks appeared, and the boys were now constantly bailing and repair-

ing. The Professor had held the tiller for more than six hours, but he did not appear to be exhausted. At every attempt of the boys to relieve him, he only said that they had more important work in bailing and caulking.

He finally changed the course due east, and it was more by luck than exact calculation that they made out the northern end of the island which was passed the first night out. In one night they had traveled a distance coming back that required two days and nights to traverse in the other direction. As it was they were headed for the cliffs at the point of land, and it must be avoided.

Harry saw the danger, and went back to consult the Professor. He had the tiller firmly in his grasp, and his body bent over it to keep it steady; but when Harry reached him, and touched him, there was no response. Almost frantic, he cried to George: "Come here, quickly; something is the matter!"

George was there in an instant, and caught up the Professor, while Harry grasped the tiller, as it was released, and turned it to starboard. The little boat responded, but Harry knew that if turned too far, the wind might catch it on the beam and crush it to atoms.

The Professor had fainted, and when George finally revived him, he looked about, and seeing Harry at the tiller, told him that he must turn to the left to avoid the cliffs, and when he was advised of what had been done, he grasped Harry's hand, and commended him for the knowledge and foresight which had been exhibited in that trying moment.

The cliffs were ahead and to the right. The

crucial time must come within the next half hour. The point must not only be cleared, but they must pass it at a distance beyond the influence of the powerful swells and waves, which are always present at points situated like this. The storm was from the west, and the promontory pointed to the north. Under the circumstances, the sea at the end of the land was a raging maelstrom, and the counter influence of the raging waves, beyond the point, offered as great a danger as at its extremity.

And now the leaks appeared at every side. Despair almost overtook Harry, and he moved from one point to the next with the oakum and the caulking tool. The Professor had insisted on again taking the helm. He had been refreshed by the few moments' relaxation. Slowly he moved over to the tiller. Would he ever make it? The boys stopped their work, fascinated with the nerve-racking intensity of it. They knew the point had been passed. The Professor smiled, and held up his hand as a signal, and the boys rushed to him and actually cried, as he put his arms about them.

It must not be imagined that they were out of their peril now. Nearly a foot of water was in the bottom. The storm was, in a measure, blanketed by the cliffs, and there was now no alternative but to reach the shore. It was fortunate that they were on the lee side of the land, but even there the waves rolled up on the shore, and the Professor knew that any landing which might be made would be hazardous in the extreme.

The vessel was approaching a shelving beach. Fortunately, from what could be distinguished of its character, it was not a broken or rocky shore.

"Boys, can you put up the mainsail?" The Professor's voice had a wonderful ring to it, for one so nearly exhausted. Without waiting to question they sprang to the halliards and drew it up, while the boat in the meantime was turned to port to ease the operation.

The boys looked on in wonder as the tiller was turned and, when the boat had gained headway, was pointed to the shore. It fairly darted through the surf and the billows which marked the shore line, but before the boat touched the beach, the Professor motioned them to come back. "Now hold fast, when we strike."

In another instant they seemed to be lifted by a giant wave, and as it receded the boat, impelled forwardly by the sail, struck the sand of the beach the moment after the tiller had been brought hard to port. The result was that the boat was now spun around with its stern toward the oncoming wind, but the impact was so great that the entire left side of the little ship was crushed like an egg shell.

"Release the boom, quickly!"

When that had been done the wrecked vessel was still, and the Professor was lifted out of the boat, but he stood there grasping the side, too stiff to move, but with that same smile on his countenance which had told the boys on so many occasions before, how gratified he was at their safety.

Poor Angel was actually a wreck. He had remained within the housed enclosure ever since the storm began. When the rocking and tossing of the boat ceased, and he heard nothing but the

beating wind, he could not understand what had happened.

All had forgotten the little animal. George was the first to go to his rescue, and found him crouching in the extreme end of the enclosure. After some coaxing he moved toward George, and when he was led out and saw about him on one side the raging waves and on the other side the land, his chatter turned to a chuckle, and he leaped to the land, shambled up the bank, and catching the limb of the nearest tree, was soon in its top, as happy as though ocean storms were unknown.

Meals had been forgotten since the day before. The boat was so high up on the beach that they had no fears for the waves. Hunger asserted itself now, and the moment the stove was brought out, Angel was down in a moment, came over to George, and looked up inquiringly into his face. It was such a comical situation, coming so close upon the heels of their great catastrophe, that he could not help laughing. He knew what that look meant, and Angel had more than the usual share of sugar. That with the nuts, of which there was always an abundant supply, was a feast for the little fellow.

After the meal a careful examination was made of the boat. The entire left side, from the bow to a third of the way back from the midship bulge, was broken to atoms. The inside of the boat was filled with sand which had been driven in when the impact took place. To repair it would be impossible without suitable lumber, to say nothing of tools. They sat down, not with a feeling of despair, so that they might the better form a judgment as to the wisest course to pursue.

"What interests me most," said George, "is to know where we are. Do you think we are anywhere near West River?"

The Professor sat there musing, but did not answer. Harry ventured the opinion that they must be far east of the mouth of that river.

Finally the Professor gave his views: "It is simply impossible for us to speculate on the course of the river, because we were unfortunate enough to pass it by in the night. It seems to me more probable, however, that it finds its way to the sea to the east of the point we came around."

"What reason have you for thinking so?"

"Simply because the mountains were not, apparently, far inland, and it seems to me that the promontory is merely an extension of the mountains or the high ridge we saw."

"I would certainly feel more comfortable," continued George "if I knew we were anywhere near the river."

But some decision must be made, and that without delay. If they were near West River the distance home was fully seventy-five miles. Preparations must be made for the trip on foot. The boat was, probably, in as safe a condition as it could be higher up, nevertheless it was concluded to take no chances, and all the provisions were removed, and by means of levers and blocks, it was carried inland fully thirty feet farther. A good supply of provisions was then taken, the guns and ammunition removed, and put in separate piles, and arranged in convenient packages for easy transportation.

The residue was carefully stored within the housed enclosure, and carefully covered over.

What grieved them most was the bedding, which must be left, but the Professor insisted that all the articles of ramie, which would afford some covering, should be taken along. They would now be compelled to sleep in the open air, with nothing else to cover them.

With a last look at their ship, they moved toward the east with heavy hearts.

Harry stopped before they had gone far. "It occurs to me that we ought to put some inscription on the boat. If any of our friends should discover the boat it might guide them to us."

"That is a capital idea," answered the Professor; and they returned to put up the proper notice.

It was past noon, but they hoped to cover at least ten miles before evening should set in, but the way was rough and broken. "I think," mused the Professor, as they halted on the journey, "we made a mistake in not following the seashore. The only reason that prompted me to take this course was the appearance of the shore to the east of our landing place. It looked so uninviting that I felt sure we should find traveling inland more comfortable."

During the first five miles of the journey the ascent was gradual, but not steep, at any place, but now the land gradually showed a change in character, growing smoother and more open, and they knew the grade had changed and was taking them down to a lower level.

Before evening came, emerging from a light wood, great was the delight at seeing a beautiful river before them. It was a broad stream, and they divined that it must be the West River, which they had so longed to reach.

CHAPTER XII

THE RETURN TRIP. THE ORANG-OUTAN

HERE they were on the banks of a broad stream, tired and hungry. The experiences which they had gone through made the task of seeking suitable shelter an easy one. An entire month of preparation had been wasted. Aside from the lights which were seen on the fourth day on the western shore, they had no more knowledge than when they started. It seemed to be very discouraging.

But they were going home. This was the most comforting thought and it made up for a great deal of the disappointments. There was real grief at the loss of the boat. True, it could be recovered, but all this meant time and hard work. It should be said, however, that at no time had either of the boys ever found fault with the tasks that were allotted to them.

In this fact the Professor found much comfort. It was a strong factor, as he knew, in the lives of the boys. It required the highest sort of courage to bear misfortune without complaining.

The camp for the night was soon made, and after a hearty meal all retired for the night. Early in the morning the boys were at work, as soon as the morning meal was finished, constructing a raft of sufficient size to carry them across, and when the timbers had been securely lashed and all their luggage placed aboard, the poles and

primitive paddles gave them a trying half hour to make the trip.

The stream was rather wide at this point, and it was believed to be near the sea, and the suggestion was made to follow the stream down for an hour, to ascertain whether the ocean would appear in view, and if not, to take up the trail for the east.

In less than a half hour the sea was in sight. The course was then directed east, but after traveling the entire forenoon through the most difficult paths, it was decided to change the course to the south.

"If you recall, we took a more southerly course when we left the West River on our overland trip, and found much better traveling."

The Professor's words recalled the incident, and the result was a change to the southeast. This was now the sixth day after leaving home in the No. 3. During the day at least twenty miles was made. Shortly before night, George, who was in the lead, stopped, and then moved forward, gazing at the ground intently.

Harry saw the movement and was at his side in an instant. "What is it?" It was not necessary to continue his inquiry. Directly ahead was a slightly cleared space, with a blackened space in the center, where a fire undoubtedly had been made, and a few bones were still scattered about as mute evidences of occupation.

The Professor looked at it a moment, and then smiled. "Don't you remember our own camp fire?" This was the case. While they could not remember the particular spot, they knew the old

trail had been crossed, and it was a comfortable, homelike feeling to come across the spot.

"Let us camp here again," said Harry, as he threw down his pack. On this occasion they did not have the wagon and the yaks, but they had an ample supply of food and there was no difficulty in making a fire.

Their first adventure came about noon of the seventh day. Plenty of evidences of animals had been found, but they were not eager to hunt. The trail for home had far more fascination than all the animals on the island. It was the custom to stop at intervals for rest. During one of these stops the cracking of bushes was heard, as though produced by a cautious tread. The boys were alert at once and, with their guns in hand, moved in the direction of the noises.

Not two hundred feet away was an immense bear, of the same species they had shot near that place nine months before. The boys separated, as they approached, under the guiding direction of the Professor, and when within seventy-five feet, Harry asked whether or not he should shoot.

Bruin was slowly moving away, not directly ahead, but as though crossing Harry's path. When the word was given, Harry took deliberate aim. George reserved his shot, as advised. The moment the shot struck, the animal turned, thus exposing a fair mark for George, who now fired. With a howl at the second shot, the bear turned toward George, who immediately ran to the right, and on the call of the Professor, circled to the right.

This brought the animal within range of the

Professor's gun, and he fired. It did not in the least check his pursuit of George, and the Professor now became alarmed at his safety. Call after call was made to advise him to turn to the right.

Harry followed as fast as he could run, and while keeping the animal in sight, could not approach closely enough to get another shot. While running, it occurred to him that he had not reloaded, and it would be impossible to reload while running.

The Professor realized the situation, and immediately reloaded, and calling after Harry, told him that he had a charged weapon. Harry heard, but he was so excited and fearful for George that he could not decide whether to stop or go on. He could see the bear, but George was not in sight.

The Professor followed as rapidly as he could. Harry saw the bear lumberingly cross a large fallen tree and pass on to the right, and thinking George had taken that course, did not wait to go up to the tree. Before the Professor reached Harry, who was now running at right angles to the course of the Professor, George emerged from his place of concealment behind the tree and laughed at the sport, which might have had serious results but for the dead tree.

You may be sure no further effort was made to follow up the bear, and they took up the search for their luggage, which had been left behind. During all this hubbub, Angel had been left with the luggage, and he now appeared along the trees, swinging from branch to branch, uttering the most fearful shrieks and chattering, as he was in the habit of doing when alarmed or excited.

"Something is after Angel; quick!" called out George, as Angel made his way over to him. Harry grasped the loaded gun from the Professor and started toward the direction from which the orang had come, but he stopped suddenly after going several hundred feet.

"The bear has our things." The Professor and George came up, and there, with his powerful claws and massive jaws, was Bruin, devouring their best morsels and playing havoc with the packages that were piled together.

The boys looked at the Professor, and he playfully answered the look by saying, "We really don't want any bear meat to-day, do we?" George thought it was a good joke on the hunters, but Harry was angered. "Let us finish him. See him break that gun?"

The Professor was busy reloading Harry's gun, which he had exchanged with him, and handed it to George. They approached, but not close enough to venture a shot, when the animal deliberately turned away and darted into the bush.

What was left of their luggage worth taking could easily be carried by either of them. Practically all of the food was gone or ruined, and the bear was recompensed for the little inconvenience by the two pounds or more of sugar which was taken.

"Well, boys, everything has its compensations. We have nothing to carry, and traveling will be easy for the rest of the trip. Let us take a good laugh over the experience."

Harry was too much annoyed, first at the failure to hit the brute and then at the mean trick in eating up and destroying their things while they were

trying to follow him. The Professor suggested that it would be fun to visit Bruin's house that night when he came home and told his family what a neat trick he had played on some hunters, and Harry laughed, but it was an awfully forced effort.

Fig. 26. Guava.

When evening came they estimated that the distance still to be traveled could not exceed thirty-five miles, and they were seeking a good spot for the camp. The Professor was the first to make his appearance with a small yellow pear, which he held up.

"What have you found now?" George inquired, as he came running forward with a branch in his hand.

"Pears!" exclaimed Harry, as he took it from the Professor's hand.

"Not exactly a pear; but a fine fruit which we can use to good advantage. It is the guava."

"What a beautiful white flower! I did not know that the guava had such a delightful odor. In what way is it prepared and used?"

"You will see, by tasting it that the pulp is very aromatic and sweet. Its principal use is for jellies and preserves, and the rind stewed with milk makes an excellent marmalade."

"Have you found many of them?"

"There are several trees over there, and it seems to me that it is a good place to put up for the night, and we can gather a quantity of them."

Fig. 27. Coffee.

Several trees were in sight, about 18 feet high, beautiful branching specimens, and beneath one of them the camp was made for the night.

While they were seated the Professor noticed the branch which George had brought. It was a stem about two feet long, with a lot of leaves on each side, and at the juncture of the leaves with the stem were rows of what appeared to be nuts. These were in the form of clusters.

He picked it up. "I thought I had made a good find in the guava, but this is still better."

"The nuts around the stem are what attracted me, and my curiosity was aroused."

"You took this from the coffee tree."

"Is it the real coffee?"

"It is the genuine article. I have searched for it from time to time. Let us go over and see the tree. We must cultivate its acquaintance."

They responded with alacrity. They were now going to have coffee. The tree was fully twenty feet high, and the branches extended out horizontally from all sides.

"Earlier in the season these nuts, as George called them, looked like cherries."

"But where is the coffee?"

"Inside the berry. Each berry contains two seeds. You know how the coffee berry looks. Let us open one of them. See, it is smaller than the ordinary berries, as you know them, but the kind we know are cultivated, which makes them larger, and fuller in appearance. These will make fine coffee, however, and I think we shall have to divide our load with the guavas."

"Where did coffee originally come from? Is it found in many places throughout the world?"

"The plant is supposed to be a native of Arabia in Asia, and of Abyssinia, in Africa. From Arabia it was carried to most of the tropical countries, but many varieties have been found in the western hemisphere. Even in Canada certain kinds of coffee plants are known. It is not, therefore, a wholly tropical plant. The Abyssinian coffee has been known from the earliest times."

"What is regarded as the best kind of coffee?"

"The best coffee of commerce is the Mocha, and

next comes Java, and the principal coffee center of the world is Brazil."

On the morning of the eighth day they were awake early, and the boys began work on the berries. Angel took a hand in the proceedings, and as soon as he discovered what the boys were after he volunteered to harvest them. At this time the berries had somewhat hardened, and when Angel knew what was wanted, his long dextrous fingers were able to strip off more of the fruit in one stroke than the four hands of the boys. Harry was on the lower limb, and as fast as he had stripped a supply, would drop them into the outstretched cloth which the Professor and George held.

Angel eyed this proceeding, for a time, and then imitated Harry. How did he ever learn the art of picking coffee berries? The orang lives principally on nuts and berries, and the instinct to gather these was a natural one.

In an incredible short space of time fully a bushel had been taken off. It was the original idea of the boys to cut off the limbs, but they had seen none of the trees before this, and the Professor advised them to pick the fruit itself. Without Angel's expert help it would have been a long job.

With a load of guavas and another of coffee, the five guns, and a few of the other relics of their ill-fated expedition, was sufficient for the two days' journey still before them. That afternoon, while resting by the side of a little stream that flowed to the north, the antics of Angel attracted atten-

tion. He was usually so quiet that no notice was taken of him.

He had two peculiar ways of making himself understood. One was a gurgling sound, which indicated pleasure and contentment; and the other a chatter, or half a shriek, when intensely excited or alarmed. But now he did neither of these things. The sounds emitted could not well be described.

The sounds were made while springing from branch to branch. When he had attracted George's attention he ran forward, usually along the branches, but close to the ground. George followed. Whenever he attempted to go back to his comrades, Angel would come back, and in his most beseeching way endeavor to induce George to follow. His actions were well understood in this respect, because it will be remembered that he directed the attention to the missing team, and afterwards rediscovered the trail after it had been lost.

"Follow him, George, and we will bring the packages," was Harry's suggestion.

It was not necessary for them to go far. Beyond, in some large trees, were three immense orang-outans, intently gazing on the newcomer. George ran back, crying out: "See the orang-outans in the trees! Isn't this the place we captured Angel?"

Harry threw down the load and was by the side of George without a moment's delay. "Where is Angel? I am afraid this is the last of the little fellow." And Harry showed his grief. They saw Angel on his way to the trees, and without waiting

for an invitation, was up among the branches, visiting his friends, and, probably, his parents.

All stood there awaiting the results breathlessly. Not a word was spoken. Without hesitation he swung himself to the last limb, on which the patriarch perched. Not a hand was lifted against him, but they looked too astonished to speak, even if they could.

Angel went from one to the other. He petted them, as George had often petted him. He knew what a caress meant, but his kin did not. It was too much for George. "Come down, Angel; good boy; come down." And he said it pathetically, too.

Not a hand was held out to him, nor did he get any sort of welcome, and yet he had expected so much, from what he tried to tell George, while on the way to his old home. It was too much for him. He heard that familiar voice, and the call that was always a welcome one, and he slowly descended the tree, not with that springy motion which characterized his ascent, but hesitatingly and in measured swings.

He went up to George and leaned against him, and then they knew that Angel intended to go home with them again. But they could not help watching the effect of Angel's actions on the animals in the trees. Ordinarily, they will quickly spring away from any intruders, as they do not generally consider the trees high enough to give protection. Their remarkable agility enables them to travel faster by the tree line than man can follow on foot.

But now that Angel was again with the boys,

all sense of fear seemed to leave the three creatures in the trees. They looked down at the proceedings, and as the boys passed by they sat in their specially prepared seats, as though they knew the care which had been bestowed on their offspring.

This little incident affected all more than it is possible to tell. The animal was really a marvelous character. True, George had spent hours and days in his education. He knew many of the words, and could execute missions, and did many things to aid George in the work at home, and it would have been a trial and a sorrow to miss him.

The next day would see them home again, and they could hardly restrain themselves at the thought of it. What if some one should have visited them while absent? Why might not the savages have found their abode? These were questions ever uppermost in the minds of all.

Before noon they reached the Cataract River to the west of the forest. This seemed like an old friend. And what was more: before they had gone many miles, the Professor pointed to a clearing, and remarked: "Do you remember this place?"

The boys looked about, as they moved forward. "I do not recollect the place," was George's answer, but Harry now recalled the fight of the bears, and the honey tree, and without saying a word he ran to the tree, which was still lying there, and said one word, "Honey."

George now remembered, and Angel began to gurgle.

CHAPTER XIII

THE STRANGE VISITOR

In the afternoon of the ninth day, emerging from the forests, the first sight that met their eyes was the flag floating from the top of Observation Hill. Never before had the flag looked so glorious, and they could not repress a shout and a cheer. The distance home was at least four miles, but tired as they were, no one felt like stopping for a rest.

Everything at the home seemed quiet and peaceful. The cattle were there, lazily scattered about, apparently not knowing or caring whether their masters were absent. The boys were moving along jauntily, happy as larks, singing snatches of songs, and amusing the Professor with sallies of wit and humor.

Angel was just as happy and was enjoying the prospects of coming home. Long before the home was neared he started off on a race, with George at his heels. Burdened as he was, it was impossible to keep up with the animal, so that the latter was at the house long before George came near. He was surprised to see Angel bounding toward him with his peculiar chattering that betokened excitement, and he stopped and hesitated what to do.

Depositing his load on the ground, he ran back, and signaled to the others. Angel came up and tried to tell them in his peculiar way of some dan-

ger ahead. Two hundred feet south of the house was a thick growth of underbrush, and to that the party made its way.

Arriving there, a consultation was had, on the course of procedure. Nothing was, apparently, disturbed. No sign of human presence was manifest. The door which opened to the main room, facing the west, was closed, as well as the room of the workshop.

"If anyone is about the premises he must be beyond the house, as it is evident some signs would show in the house or shop. Prepare your guns and let us go forward."

The house was cautiously approached, and reached, and Harry quietly gained the door, and the secret bolt opened. The door was slowly opened and he peered in. It was unoccupied, and all rushed in. A small trap-door on the northern side was now opened, which gave a view toward the shop and cattle-yard.

What they saw there startled them beyond measure, for seated on a log, outside of the cattle-shed, was a man, with a straggling, unkempt beard, vacantly gazing into space.

"How shall we attract his attention?" asked Harry, breathlessly.

"Let us rush out the front door. He is, apparently, alone."

At the signal, with their guns ready, they filed out, and moved toward him. He raised his eyes, and at first was a little startled, but again relaxed, and seemed to take no particular notice of their approach. The Professor walked toward him, and held out his hand. The stranger made no motion or protest, either of fear or recognition,

and as the Professor's hand touched him, his hand was involuntarily extended.

Not a word was uttered by him. The Professor turned to the boys. "He is demented, or has lost all knowledge of his condition or surroundings. Poor fellow!"

The Professor addressed him. He looked startled at the sound of a human voice, and as the voices continued, began to look inquiringly at one and then at the other. He was a man fully fifty years of age, strong, well built, but somewhat emaciated. His eyes had no luster, the beard was long and shaggy, and aside from the torn and almost unrecognizable trousers, the only article of clothing was an equally dilapidated shirt.

George grasped Harry, excitedly. "Where did he get that shirt? That is the one we used as our first signal flag, and which we lost five months ago." Such was indeed the case. The only thing in its torn and tattered condition, which enabled him to recognize it were the initials of George, which he had noticed.

Thus was one of the mysteries explained. Despite every attempt at conversation, not a word escaped his lips. The Professor took him by the arm, and led him to the house. He entered and looked around not particularly interested, but more in curiosity than otherwise.

"What do you suppose he has been living on, and where has he been staying?"

At the suggestion of the Professor, some food was brought, and placed before him. He gazed at it. A knife and fork were on the table. He reached for them slowly, and when he had grasped both began to eat ravenously. He finished with-

out looking up, and when the last morsel was eaten stared about, and a faint smile appeared, which was the first facial change that had crossed his features since they met him.

He was conducted to a reclining chair, and such articles of clothing as they could find were brought out and laid before him. He gazed on them, and slowly picked up one after the other. His feet were bare, and appeared to have been scratched and torn, but they were hardened by contact with the earth. An old pair of shoes, the ones discarded by the Professor, when they turned out the first lot of shoes, was set before him.

He picked them up and mechanically put them on. "Now let us leave him alone for a while." They went out, closing the door, and Harry stole around to the small port which he had opened, and watched the stranger.

His demeanor did not change after they left; he simply glanced about the room. When his eyes fell on the table, he arose and cautiously approached, and suddenly seized the table knife, with just a slight change of countenance. This he attempted to secrete beneath his ragged shirt.

"Do you think he is dangerous?"

"His malady is a peculiar one, and arises from various causes. I do not think we need fear him."

"But see how he took that knife."

"That was simply an instinct; that of self-protection. Any other implement would have been as acceptable as a knife. Possibly, the sight of the knife, temporarily, may have brought back some glimmering remembrance of his sane moments."

"Do you think he is insane?"

"No; it does not appear to be of such a character. He seems to exhibit loss of memory. Imbecility, idiocy, and lunacy exhibit marked tendencies, and have been made the careful study of many eminent men, and it is even now one of the disorders least understood by the medical fraternity."

"What is a lunatic?"

"Blackstone, the great English authority on law, defines it as 'one that hath had understanding, but by grief, disease, or other accident hath lost the use of his reason.' This eminent authority also stated that lunatics may have frequent lucid intervals, and might enjoy the use of their senses during certain periods of the moon. It is from that source we are indebted to the still prevailing idea of the moon's influence on the human mind. That view was exploded long ago, and shown to have no foundation."

"What is the difference between a lunatic and an insane person?"

"The original term was lunatic, in accordance with Blackstone's definition; but in medical science the terms insanity and mental alienation have taken its place."

"Doesn't he act peculiarly? He does not seem to know we are present. What I cannot understand is, how he knows enough to get anything to eat."

"That is a peculiar thing in nature. Here is a man who has, outwardly, the appearance of an intelligent being, incapable of talking, or uttering intelligible sounds, with memory so submerged that he doesn't, likely, recognize his own kind, and yet has been able to find food for at least five

months, to our knowledge. It shows that, irrespective of mind, nature has implanted some kind of an instinct of preservation in living beings. The subject is one that has been discussed from many standpoints, and it can never be exhausted."

The boys now went over the entire premises, carefully examining every part. Evidences were plenty to show that the man had slept in the shed adjoining the stable, and the shells of nuts as well as barley heads were found around the place he had slept.

There was everything to indicate that his trials and sufferings on the island had deranged him. Probably his was a case like many instances known, where consciousness of self—the absolute loss of memory, had caused disappearances, and many instances have been recorded where intelligence finally asserted itself and brought back former recollections.

The instinct to clothe himself was shown when they returned. The Professor went up to him kindly and spoke. The words were repeated in German and French, but not one word did he utter, nor did he give the least visible sign of recognition.

During the afternoon he wandered around from place to place. The boys were too much fascinated to turn their attention to anything. George started out for a trip to Observation Hill, accompanied, as usual, by Angel. The strange man was passed on the way. Without a sign he followed. George was a little frightened, but soon recovered, as he walked along unconcernedly.

They crawled up the steep ascent, instead of going around the gentler ascent, and when the pole

was reached, the stranger for the first time took any interest in anything he saw. He looked up at the flag, and then out over the sea, and as he did so, he put up his hand to shade his eyes from the glare of the sun. This was the only human thing which was noticed about him.

When George left, he followed, walking erect, and he could not help admiring his strong, although drawn, features, and the admirable build of his frame. He would be an antagonist to fear as an enemy.

On the return, George stated the occurrence, and the Professor said that the man was no doubt used to the sea, as his walk betrayed that, and the incident of shading his eyes is a common one to all seafaring men.

But now came up the great question of the future course to be followed. What should be done? The determination to again attempt further explorations was fixed in the minds of all; but how should it be conducted? Should they again brave the dangers of the sea, or make the next trip by land?

The only means available by sea would be the partially damaged boat, which was seventy-five miles away, and plans were considered either to bring it to the Cataract by boat, or to repair it where it lay; either course had its disadvantages.

One day the stranger wandered over to the workshop where Harry was engaged. He had never been inquisitive, as nothing seemed to interest or appeal to him. When he saw the machinery, the lathe, and, finally, the electric battery, he stood still and gazed. Slowly he made his way to the battery which had the terminal wires lying

loose. He picked them up, and brought the ends together, and the spark seemed to fascinate him. The experiment was repeated several times, but the wires were soon dropped, and he resumed his usual demeanor.

Harry ran over to the laboratory, and informed the Professor, who came at once, and arrived just as he was dropping the wires.

"The best thing for him is something to do. In this way, the association with tools, if he has any knowledge of them, may awaken some recollections of his past. I have watched him for the past three days and I am sure he is not deranged, in the sense of being demented. Let us try what employment will do."

Harry was engaged in dressing a board with a plane when the man came in. The Professor led him to the bench and placed a plane in his hand, and by making a motion with his hand and pushing the man's hand along with the plane, he took notice of the motion and mechanically drew the plane back and forth.

He not only planed the board, but he followed up the roughened parts and finished the job in a workmanlike manner. The saw was placed in his hands, and he handled this with a facility that surprised both of them. He did not look like a mechanic, but on the other hand had every appearance of a literary man, but he was, unquestionably, used to tools.

After considering the all-important question of the exploring expedition, which subject was an ever present one, it was agreed that the wisest course would be a trip by land. They now knew

the location of the inhabitants of the island, and with proper equipment, they ought to be able properly to defend themselves. Another element which might prove of value to them was the new acquisition in the man who had come so unaccountably to their home.

One of the first things necessary was to give him some name by which he could be known, and which he would in time recognize. This was debated over and over, without coming to any conclusion. Eventually, in the absence of anything better, it was decided to call him simply John.

When Harry went to the shop where he was at work, he addressed him as John; and at the uttering of the word started, as though he had been alarmed. Harry noticed it, and repeated the name several times, with the same result, and he hastened to inform the Professor of this experience. The Professor went down without delay, and it was evident from the actions of the man that he recalled something familiar in the name, as in every instance he would put his hands to his head and give an inquiring look.

"It is my impression that John is his name, as he would be more likely to remember that than anything else connected with his life. Let us keep him occupied, and his work may also be the means of bringing back familiar things."

The boys, in company with John, set about preparing a good bed for the newcomer, and he took a part in it most heartily, and seemed to understand when the Professor pointed to him and the bed that it was intended for him.

The interest was more intense when he was taken to the boathouse, which Harry had opened,

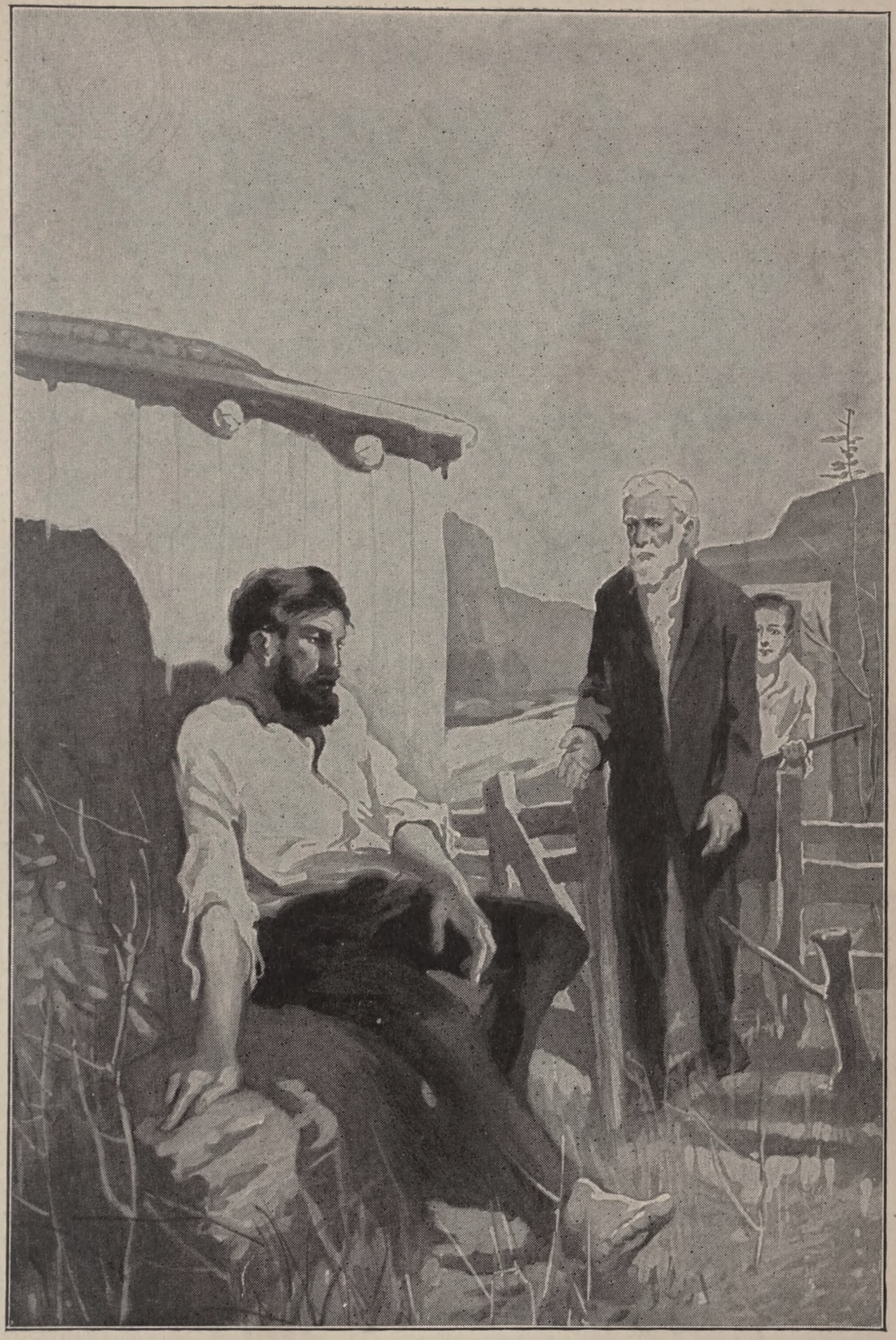
and when he saw the boats, his eyes opened wide and grew brighter, but they suddenly lost their color and he relapsed into his former state.

It was truly pitiful to watch him, and when in the evening they sat together and conversed, they felt that at times he must have gotten some glimpses of his individuality.

In the morning when George went out to the cattle pens to milk, he mechanically grasped a pail and followed, and the milking operation seemed to be a familiar one to him. Thus, he was a mystery, for the reason that he seemed to be at home in every direction where it called for any special activity. This was made the more mystifying when, during the next day, he wandered over to the laboratory, and his eyes caught sight of the skulls and the skeletons which were on exhibition.

He walked over to the skulls, and picking up one poised it on his hand, slowly turning it around, as though trying to discover what it meant. The one selected had one side partially crushed, and this attracted his attention. He placed the fingers of the other hand in the shattered part, and seemed to realize that some agency must have caused it. The whole deportment while examining it was that of one who was called upon to make an examination of it for the purpose of determining the cause of the injury.

When he laid it down, he looked at the Professor, who quietly took up the skull and pointed to the fracture, endeavoring by his conversation to strike a word or keynote by which some recollection would be started; but he was mute and soon again became listless.



"The professor walked toward him and held out his hand"

[See p. 158]

CHAPTER XIV

AN EXCITING TRIP TO THE FALLS

The food supply was now the first thing to consider, as all necessaries in the way of vegetables, as well as meats, had been exhausted when they started on the last trip, and a new lot had to be laid in. The matter of butter was always a hard problem to take care of, and George referred to this difficulty, and before they sailed away the Professor told him that, on their return, the first thing to do would be the construction of a machine which would simplify the production of the butter.

"As we are going to use more butter, I think it would be a good thing to start in on our cream separator," said George, who, while he was not an adept, like Harry, to devise the things required, was always ready to suggest things that could be made to advantage.

"I know that Harry will be very glad to set to work on that, so we might as well commence," answered the Professor.

"What is the principle of the separator that causes the cream to break away from the milk?"

"Centrifugal motion is employed to bring it about."

"But how does that motion affect it?"

"When you put a ball on an elastic and swing it about your head in a circle, the elastic stretches in proportion to the speed at which you swing it.

You have probably seen it done. It is stretched in proportion to its weight, also. These two things, therefore, are properties of centrifugal motion. Cream is the fatty portion of the milk. It is contained in little globules, and when the milk is allowed to stand, the milk surrounding the globules, being heavier than the cream, forces its

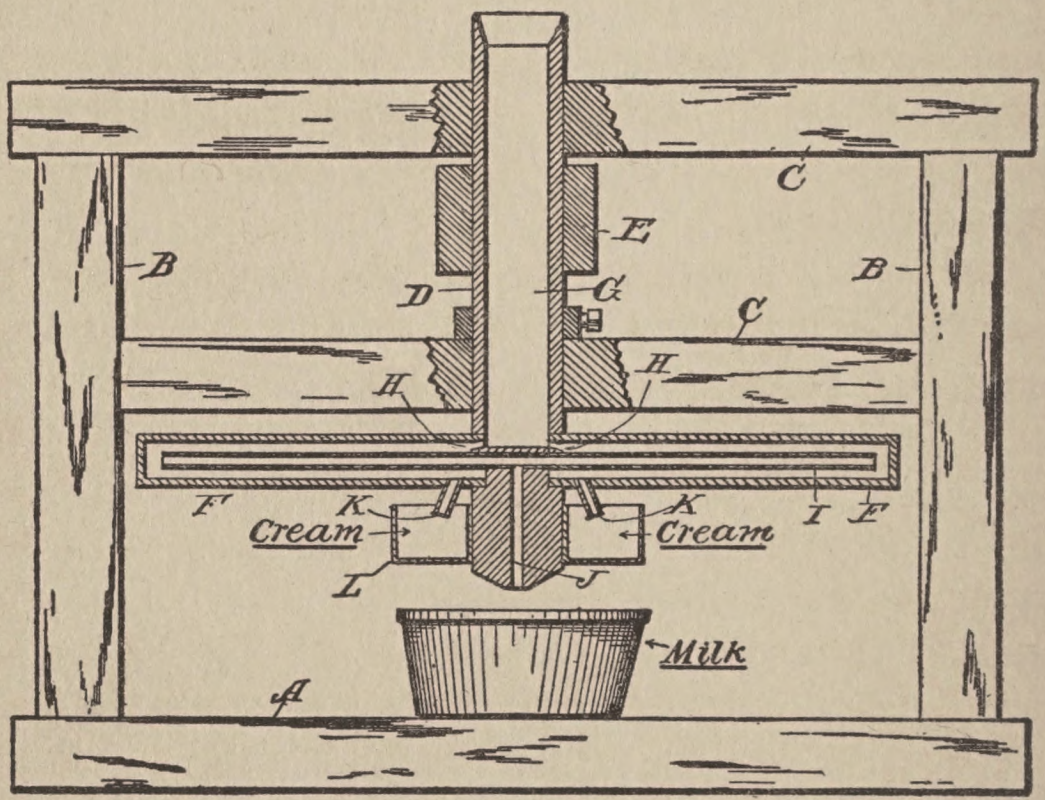


Fig. 28. Cream Separator.

way to the bottom, and the cream by that means goes to the top. The inventor has taken advantage of this fact by making a machine which will take the milk and impart to it a very high centrifugal motion, and in doing so the milk particles, on account of their greater weight, force their way outwardly and the cream inwardly. The machine is also so arranged that the cream and milk

are drawn from it at separate points, and this operation is a continuous one."

Harry quickly understood the machine from the drawing made for his guidance, and in Figure 28 a sketch is made, showing how it was constructed.

A frame was made which had a base (A) and two standards or uprights (B, B), and between these uprights were a pair of horizontal bars (C, C). These bars served as supports for a vertical tube (D), the tube being journaled in the center of the cross bars, so that it extended above and below the bars, and had a small pulley (E) between them.

Below the lower cross bar the vertical tube has two radiating tubes (F, F), closed at their outer ends, but communicating with the bore (G) of the tube (D) by means of two orifices (H, H). The bore (G) extends down to a point a little below the orifices (H, H), and a small tube (I) runs through the tube D, within the tubes F, F, the ends of the tube being open. A duct (J) centrally through the tubular piece (D) communicates with the bore of the tube I. One each side of the tube D is a little tube (K), which communicates with the inner end of each tube (F). A receptacle (L) is attached to the tube D below each tube (K), to catch the cream.

The operation of the machine is as follows: When milk is poured into the top of the tube D, and the latter is set to rotate at a high speed, it passes down and out through the ducts (H, H), into the horizontal tubes (F, F), with the result that the cream is prevented by the heavier milk from reaching the outer open ends of the tube I. As

a result, only the milk passes inwardly through the inner tube, and is discharged downwardly through the duct (J), whereas the cream passes out through the small tubes (K).

The quest for a supply of vegetables was now a part of the daily occupation of some in the colony, as the garden had not yet advanced to that stage where anything could be gotten from it. One morning John was missing, and there was a great deal of speculation as to his disappearance.

Before noon he reappeared, carrying in his arms as large a quantity of vegetables as he could carry. Harry was the first to see and welcome him. He recognized beets and was delighted to find that John understood what they were after. When the Professor was informed, he gave a hearty welcome, and John seemed to recognize that his efforts were appreciated.

"Ah! I see you have some onions," he said, as he beamed on him.

"Onions!"

"Yes; the wild onion, the progenitor of all the onions. One variety of this is a species called chives, used as a salad, and is known throughout Europe under that name."

"But this beet is very small; is it also wild?"

"There are four varieties of the beet. This is the most common of them all, and grows in a wild state in many parts of the world. The Mangel-wurzel is a larger beet, and coarser, and is much used for cattle feed. If you want to give your cows a treat, this would be the food to give them. Then there is a kind called the chard, also a good variety. If possible, we should try and get John

to show us where he found them. Undoubtedly it was along the sandy part of the island."

The first real surprise manifested by John was when the yaks were hitched up and he was invited to join them on a trip. His eyes seemed to show some glimmer of intelligence when he slowly crawled up into the wagon. Their course was directed toward the forest to the west, and the trip there, which occupied nearly two hours, was a constant source of pleasure to all.

On the way the animals were stopped at intervals to allow the Professor and George to collect specimens of plants and to seek for ores. And here occurred the first real symptoms of returning consciousness on the part of John. As the Professor was moving toward a hill, with a small pick, he was seen to pick up one of the little hammers and follow.

Without seeming to notice either of the party, he undertook to explore on his own account, moving here and there along the hillside and occasionally stopping to examine and chip off samples, which he carefully laid down, but when this was done, entirely forgot to collect them. The act of procuring the samples seemed to be the absorbing element. He thus went on, never returning to the places where they were deposited.

"That action on his part shows a remarkable phase of his malady. Notice how carefully he puts them down and how uniformly he forgets that he has done so. The mind, in his condition, is so disordered that it cannot reason with any degree of sequence. He recalls only one thing at a time; but if I am not mistaken, he is a man of

culture, and his every act shows that he was a man of broad intellect. I hope we shall be able to restore him to his normal condition."

The guns had been taken along, as usual, in order to do some hunting, and while the Professor and John were engaged in prospecting, the boys were after game, in which they were more than ordinarily successful, the bag for the first hour being a half dozen pheasants and several squirrels.

When the Professor returned to the wagon with several loads of samples which the two had gathered, George insisted on penetrating the forest still farther, their direction being toward the falls in South River. Before long they came across the trail which had been taken by the yaks when they made their flight some three months before. They were now not to exceed two miles from the falls.

Angel, who was with them, now began one of his peculiar chattering exhibitions which betokened alarm, and the yaks exhibited a restless disposition. Harry moved forward to ascertain the cause, and before he had gone two hundred feet, saw the cause of the disturbance. It was one of the largest bears which they had so far seen, standing alongside of a large fallen tree and vigorously working his immense paws.

He ran back to the party and gave the information, and the Professor seized a gun, but John instinctively, as it were, grasped one of the spears and darted forward in the direction Harry had taken. The bear paid no attention to the party, and when the Professor came up, he said: "How fortunate it is that we shall be under obligations

to the bears for our second treat of honey. I do not think we ought to attack him after rendering us this service."

John was restrained from going forward, and he cast a peculiar glance toward the Professor. "If there is honey there," replied George, eagerly, "let us drive him away, at any rate."

But Bruin would not be driven away. He sprang down from the log, growling and pacing back and forth. Occasionally he would leap back on the log. It was plain that he was after the honey and regarded it as his special property.

"Well, George, suppose you give him a shot as a reminder that we need some of that honey?"

He needed no urging, and taking a rest alongside a sapling, fired a shot with one of the long guns. The shot was answered by a terrific growl, which ended in a prolonged roar. Without waiting for another summons, he made a line for George, who ran back. This was more than John could stand, who now ran directly to the bear with his sole weapon, the spear.

Neither of them could restrain him, but all sprang after him. It was a challenge the bear sought, and John did not in the least check himself until within ten feet of the animal, when, with a light spring to one side, he directed the spear against the side of the bear as he passed in his rush. While the spear entered the animal, it did not reach a vital spot.

Harry was about to fire, but the Professor held up a hand. "Have a care, unless you are able to control yourself well. You are likely to hit John." The bear turned, but John made no motion to

avoid him, and again the bear charged. This time John did not jump aside to exceed two feet, and again plunged the spear forward, and as the bear's lumbering body moved forward fully ten feet or more before he could bring himself to a halt, they saw that the spear had broken off, and the terrific growl of the animal showed how badly he had been wounded.

John made no effort to escape, although he plainly saw the broken end of the weapon, and the Professor, surprising as it may seem, did not encourage a shot. The effect of the last stab was apparent, however, as Bruin did not turn after the last attack, but, with an expiring growl, sank down.

He was a magnificent specimen. The Professor went up to John and held out his hand in recognition of his wonderful feat, and he seemed to realize the nature of the commendation bestowed on him.

The work of skinning the animal was participated in by all. John seemed to enjoy it, and by his actions showed that he was at home in this sort of work. You may be sure that his actions throughout the day were such as to give him a warm place in their hearts, and they recognized what a valuable ally had come to them.

The excitement made them forget the honey tree. They were recalled to that by Angel. He had made his way there after the battle ended, and was now in the seventh heaven of delight, and when George arrived to take possession, Angel was covered with a mass of the delicious sweet and fairly gorging himself.

As no provision had been made for carrying the honey home, the boys remembered the first attempt at conveying it, and after the skin had been removed, it was taken to the hive, and it was a pleasure to all to remove the comb and every part of the coveted treasure. A luncheon was prepared, and for the first time in two months the use of their sugar was dispensed with.

"As we are so near the falls, why not go there, and possibly the sight of it may recall something to John?"

George and Harry looked at the Professor for an inkling of his reason for the remark, but he appeared not to notice them.

As the distance was not great, the course was directed along the very trail that the runaway yaks had taken from the river some months before. The moment the river was reached, John sprang from the wagon and made his way to the shore and stood there gazing, and as his eyes turned to the right and he saw the falls, he slowly turned to the Professor, as though he was about to say something, but there the quest of his eyes ended, and all recollection seemed to leave him.

George could not restrain himself any longer. "Why did you make the remark that it would be well to bring John here to see whether or not he would be able to remember anything?"

"I was anxious to see if he would recognize the stream, and possibly recall the boat."

"What boat?"

"The boat we left here."

"And do you think John took the boat?"

"It is my opinion he took the boat, and then

forgot it. During that lapse it was washed down to the sea by the flood."

"But how do you account for the oars and the rope which we found in it?"

"He must have put them there."

"Where do you suppose he got the oars and the rope?"

"That is the peculiar part of the problem. The rope, if you will remember, looked as though it was made by savages. At any rate, it was not a regulation rope; but the oars were undoubtedly taken from the *Investigator's* lifeboat."

This was interesting news to the boys. It did seem probable, after all, that John had something to do with the lifeboat as well as their own boat.

CHAPTER XV

THE STORY OF THE CAVE

An hour or more was spent on the shore of the river, passing along its banks and investigating the proximity of the falls, but if there was a glimmer of intelligence, John did not exhibit it. All realized this one thing: that if his memory could be brought to its normal condition, he would be able, undoubtedly, to reveal some of the mysteries they longed to unravel. For all they knew, he might have been one of the crew of the *Investigator*, but this, after all reflections, was out of the question, because life on shipboard is rather intimate, and boys, above all others, are most likely to remember faces.

Neither had the slightest knowledge of ever having seen him, and it was now felt that they must await the time when he would again regain his consciousness by the orderly course of nature.

While on the way home, George, who was seated by the Professor, mused over the occurrences of the day. "It has always been a wonder to me to know why it is that humanity must always be surrounded by a mystery of some sort. It seems there is always something just beyond him, and he must struggle and work to find it out. Why is it?"

"You have asked the great question of the ages. It is an eternal question. Why should man know everything? That would be omnipotence. If you

stop to consider, it will occur to you that the moment man knows everything he ceases to be a man. All energy, all effort, and every instinct in life fades away. The association of man with man would cease. Take the simple act of one lady calling on another. Do you think it is merely to look at her friend, or is it done to make some inquiry? Every action in life has in it some desire to acquire something, to get that which man did not possess before. The quest for the things of this life become and are the great pleasures which man enjoys. It is not their possession. Men pursue pleasure. That is a seeking after something just as much as hunting for wealth."

Returning to their home, the samples which the Professor and John had gathered were carefully taken to the laboratory, and several of the large copper receptacles cleaned for the honey. This was the part which Angel enjoyed more than anything else. And here it may be remarked that, when John was installed, Angel was a little shy with the stranger, but gradually became accustomed to his presence. Somehow John could not fully understand the creature, and often would be seen following his motions; but within a week Angel would permit himself to be caressed without objection, and he seemed to know that no harm could come from the kindly faced man.

Notwithstanding the mystery of their new friend, there could be but one course to follow. They lived on the island and were a part of it. The longing to know what the other side of the island contained was an ever-constant inquiry.

Something must be done to forward their efforts in that direction.

During the four weeks at home a good supply of provisions had been gathered, and now the plans were made for an overland journey. The wrecked boat was still near the mouth of West River. It would be a week's trip to bring it home, and this was not considered advisable, particularly as the monsoons were still blowing, with greater or less violence and frequency.

It may well be imagined that the boys had not forgotten the cave. It was their constant talk by day and their dreams at night. It had a fascination which was constantly drawing them in that direction, but, singularly, they never entered it. But one day George suggested that they make a search on their own account. Harry quickly assented, and taking up the two lamps, together with their weapons, were soon at the entrance.

They cautiously went down the stone steps and directed their way to the recess where the treasure was deposited. The skeletons had been buried on a previous visit, so they did not have that grim recollection to ponder over.

What interested them most was the chamber to the east which had been examined by the Professor, and to that they made their way. During the first two hundred feet the direction was to the east, or nearly so, and then the walls suddenly turned to the right, and here a sight met their eyes which bewildered them.

The chamber was a gorgeous one, not so large as the one in which the pirates had their booty, but the calcareous hangings on the walls were far

superior and possessed greater decorative effect. From a point near the center of the cavern, they turned and examined all sides, and to the south was what appeared to be an outlet, and this was approached.

They moved nearer with a silent tread, as though fearing the ghosts of the past century would rise to receive them. They saw a recess, cut like a room in the side of the walls, symmetrical in form, and fitted with all the comforts and luxuries that humanity could wish, but it was crumbled, and crumbling, and everything fell at the touch.

Here, scattered about, were the remains of a table, and among its crumbled ruins were gold and silver vessels. There was a mass of debris, among which could be recognized articles of human manufacture and use, but all covered with the everlasting carbonate of lime, which gave it the color of death and the shroud of a sepulcher.

Not a word was spoken. They moved from place to place and touched the objects. What appeared to have some resemblance of a rigid form fell away, just as they had seen it in the other portion of the cave. What surprised them most was the entire absence of any firearms, although they remembered that the Professor had said the other portions of the cave would show that the pirates had plenty of guns.

This incited them to further search. Could it be possible that the Professor had not seen this part of the cave? Their own tracks could be made out in the soft stalagmites on the floor, and retracing their steps to the center of the chamber,

they searched back and forth to determine whether or not he had visited this portion.

Nothing was found to satisfy them on this point, but, passing on beyond the first recess entered, they were amazed to find a second grottoed recess, similar to the first, but much longer, and here, with merely a wall separating them from the other recess, was an orgy of bones and weapons.

It was such an unlooked-for sight that they almost staggered at the scene. At one side was a row of chests, fully six feet long, all white and crumbling, and these were filled with the long Spanish guns of which they had several specimens.

Here everything was in confusion. The final act in the drama enacted here, whether before or after the battle in the other chamber, bore evidences of annihilation. Here were skeletons, locked in their dying embraces, still grasping cutlasses with which they closed the act. But what interested them more than anything else were four skeletons, reclining on a raised portion, with chains on wrists and ankles, which looked like a mockery in their surroundings.

The captives had taken no part in the struggles. Were they being defended? and who were the captors? The boys had no time to consider these things. Other matters attracted them. The nook close by was a veritable arsenal. It contained chests which, undoubtedly, were filled with gold. The sights, their surroundings, the evidences of untold treasure everywhere were enough to unnerve them for the time, and George, with a voice almost hoarse, suggested that it would be

well to return. It was some time before they could make their way back to the entrance, and when it was reached, they sat down, not knowing what to say or what interpretation to put on the last discovery.

Nothing was said to the Professor about the visit to the cave. It must be confessed that they felt a little sheepish about this, as such a thing as deceiving the Professor was farthest from their thoughts, but there was no concerted agreement to keep him in the dark. Either would have scorned to enter into such an agreement.

The boys were more than surprised that evening when the Professor brought out some of the treasures he had brought from the cave and exhibited them. Among them was a crude implement of stone, which had the appearance of a cutting instrument. Another was a small stone vessel, unmistakably showing human manufacture.

The sight of these did not, at first, interest the boys, but when the Professor stated that the cave was undoubtedly of very ancient origin, George could not resist the inevitable question, "How can that be determined?"

"In the study of paleontology an effort has been made to classify the different periods of man's life on the planet, so that we have the stone age, which is the earliest, the bronze age, and the age of iron."

"How far back in the history of the world has evidence been found of the existence of man?"

"In the chalk cliffs of England, and also in like formations in Germany, skulls have been found

which indicate an existence back to a period fully 500,000 years ago."

"What reason is there to assume that if they were found in those chalk deposits, that they must have been that far back?"

"Because it was fully that long ago in the period of the world formation when the chalk beds were made, and this seems to be conclusive evidence of great antiquity."

"Is it not singular that more evidence of that condition is not found than the recovery of a few bones?"

"Not when it is considered that the earth is constantly undergoing change, first in one place and then in another. Have you ever heard of the great continent, which was supposed to be lost in mid-Atlantic, called Atlantis? Plato refers to it, and attributes the first knowledge of it as coming from Solon, who visited Egypt and there learned from the wise men that a great country, to the west of the Pillars of Hercules, which Gibraltar was called in ancient times, had disappeared thousands of years before; and they further informed the great Grecian lawgiver that the earth had been peopled and repeopled many times before in ages past."

"Why was it necessary to repeople the earth? Were they all destroyed?"

"They pointed out that at certain stages of the world's history great floods came and destroyed all the people inhabiting the low places, and at other times the terrific volcanic eruptions destroyed those who lived in the hills, and at other times entire continents, like Atlantis, disappeared,

so that the earth had to be repeopled and the arts and sciences learned over anew."

It is wonderful to relate how the life on the island affected the health of all. They lived outdoors and had plenty of sunshine and vigorous exercise. In the laboratory, the Professor made it a constant habit to do all his work in the sunlight, to which he exposed himself at all times. The boys often spoke of this, and one day, while talking on the subject, he remarked:

"It is surprising how little the majority of people value sunlight. It is not the visible sunlight that performs the wonders in giving strength to man. If you recall, we spoke about the actinic rays which cause the chemical changes on the photographic plate. It is those unseen rays which produce the aurora borealis, exert a curative effect upon leprosy and tuberculosis, fill the atmosphere on the sunny side of a street with oxygen and nitrogen, and do many other marvelous things."

"In what manner does the invisible light produce these results?"

"In its sparkling radiations microbes die, decay ceases, the iron in the blood becomes chemically strong; ozone is manufactured from the dirt and dust, which are also destroyed; the perspiration becomes active and carries off waste from the muscles and cleanses the skin; dead tissues are purified and the muscles invigorated; and all life is made to thrive."

"Does the sunlight have the same effect on all the animal creations?"

"This is true of all animate life, except minute organisms, or what are called bacteria."

"If that is the case, why do worms and the like hide themselves in the earth?"

"In that case it is the instinct of self-preservation. The most of them are eyeless, so that sunlight exposes them to birds and other enemies. Professor Mast demonstrated that they are very favorably influenced by exposure to sunlight. Dr. Dolly has shown, by a series of very brilliant experiments, that the butterfly will live three times longer in sunlight than in the shadow; and Professor Yerkes has also proven that the jellyfish, while inactive in the dark, becomes very strenuous in sunlight."

"If that is the case, why wouldn't it be a good thing to have all houses made of glass?"

"That is really what has been proposed. The Government of the United States has set a good example in this respect by devoting over one-half of the space of the new post-office building in Washington to an arrangement which permits the interior to be flooded with sunlight."

In the really strenuous times which our colonists had passed through the pleasures of fishing had been forgotten, and as that was an article of food which all relished, and of which they had been deprived for some time, Harry insisted that at least a portion of the following day should be spent in that way.

John saw the preparations which were going on and entered into the spirit of it in his usual listless way, but it must be said that there was

now more eagerness in his actions than had been theretofore noticed.

All saw the change that was perceptibly coming over him, and the particular thing that George noticed was the character of the eye. "I wish you would explain, Professor, why it is that the eyes of people so affected are dull, and that when they recover the eye becomes bright?"

"That change in the character of the eye is expressed by everyone under certain conditions. How much brighter the eye is when you are affected by laughter. That is due to the duct which lubricates the eyeball. Anything pleasant causes an undue amount of discharge, so that the eyeball glistens, and we call it looking bright. The same principle holds good in the case of one who is dull or listless, or, as in our friend's case, has nothing to stimulate the flow of the secretions. The moment he is affected, this is shown on the eyeball sooner than by any other part of his body."

It will be remembered that in a former volume it was stated how Harry had prepared a number of very creditable fishhooks, and these were now attached to the ramie fiber cord and suitable poles were easily obtained for the day's outing.

Aside from John, it was a merry party that left the Cataract that morning, and Angel was among them. Several good fishing spots were known, but the Professor suggested that a change be made and that the trial for the day should be in the river below the Cataract, in the hope that larger and gamer fish might be found. In all former trials only the tame fish were caught.

Less than a quarter of a mile below the Cataract, and close to the mouth of the river, was a small cove, with deep water, bounded by a sandy shore. Here the party stopped and cast their lines. The Professor, however, used a fly and fished with it at the surface of the water. As on the previous occasion, he was the first to land a magnificent specimen, which was so large that he had difficulty in landing it.

"What is that beauty?"

"It is a salmon; or it might be more correct to call it a salmon-trout. Trout belong to the salmon family, and they are all game."

"Well, he certainly made a fight for it."

"Does the salmon live in salt as well as in fresh water?"

"They have a habit of remaining off the coast in salt water during the winter months in northern latitudes, and then entering the rivers when the spawning season begins, ascending the rivers slowly, despite every obstacle that may be put in their way. When they reach a favorite spot, the eggs are laid and are hatched out in countless numbers."

"Has it been discovered why they do this?"

"In order to escape their enemies, who seek the eggs. Even with the care which they take in breeding, millions are destroyed, and it has been estimated that if all the eggs laid were hatched out the number would be so great as to prevent navigation along the shores of the coasts where they thrive. In the rivers of Oregon and Washington the shoals of salmon are frequently so

great in the rivers as to make it impossible for a boat to be navigated through them."

Harry was awarded with the second catch, which was fully fifteen inches in length. It had a nearly cylindrical body, covered with exceptionally large scales, and its head above convex. The striking thing about it was the color, the back being of a bottle-green, light on the sides, and silvery white underneath.

The Professor was on hand at once. "You have captured a fine specimen of the mullet, not considered, generally, as a game fish. It is a particularly fine table fish."

George came in for his share of luck, as well as John, who seemed to enjoy the sport immensely. His eyes showed that. It was a pleasure to all at this opportunity to bring something into the life of the poor unfortunate so that he might be brought back to light again.

CHAPTER XVI

MUSIC AND ANIMALS

During the evening George suggested that as the trip was to be overland it might be wise to can some of the fish, or to use some of the receptacles found in the cave for this purpose.

"We might do that," said the Professor, "or they might be salted down, and that would not necessitate the receptacles, if we dried them."

The salted fish did not appeal to either of the boys, and it was accordingly agreed to put up several packages for food.

"Will it be much trouble to preserve them by putting them in cans?"

"If proper precautions are taken they can be preserved. The difficulty is that the air is not excluded, and the mischief is caused by the gases which form, in that case, and when the pressure becomes too great the receptacle bursts."

"Why are the fish, or other substances, so canned heated and put into the cans while in that state?"

"When a can is filled with the material in a heated state it has been expanded to its highest point, and after the package is sealed properly, no air can enter it, so that it is prevented from changing its condition by any chemical action. Our difficulty will be to get a proper metal for the cans."

"What is the best to use?"

"Tin, for the reason that tin is not affected by any of the acids which are formed by fish or by fruit, which may be put in them."

It has been stated that the boys were both musically inclined, and George had taken several courses of lessons on the violin before he joined the training ship. If there was anything more than another that was missed, particularly in the evenings, it was the lack of musical instruments, to which all had been accustomed. As a result, the boys had for some time worked on a violin, which was now nearing completion, and they hoped it could be finished before the start was made.

The Professor discovered the partly constructed violin, and at once showed his appreciation of their enterprise. "Now that you have the body, what are you going to do for strings?" and he laughed at the bewildered look. They had forgotten the one essential thing.

Without a word, he left them, and when he returned, held in his hand a dozen or more hard, bony-like and dried-up reeds. "Possibly these will do for your purpose."

"What are they?"

"These are the intestines of the wildcat we shot about ten months ago."

"Well, aren't they as good as the intestines of the common cat?"

"Undoubtedly; but violin strings are not produced from that source."

"Aren't they known as catgut?"

"That is true; but it is a mistake. The strings of commerce are made principally from the intes-

tines of sheep, and, singularly, have been always designated as 'catgut.' Other articles from the same source are hatters' bowstrings, clockmakers' cords, and thongs for whips and laces for boots."

"What are the best kinds of strings for musical instruments?"

"Those obtained from Milan, Italy, are considered the best, on account of their transparency and exceeding strength. Most frequently each string is made up of two or three separate strands, twisted together with the utmost care. But there is another use of the greatest value, and that is as a thread for sewing up wounds in internal surgery, because, being of animal matter, the thread will, in course of time, be absorbed into the system, and thus remove itself, without requiring a second operation to remove it from the wound."

"How is it prepared to make it suitable for our purpose?"

"The ones here I thoroughly cleaned at the time, as I knew they would come in handy for particular purposes, but I had no idea of this kind in view at the time. We must soak them and remove the inner and outer lining. Potash, in solution, is best for the purpose. We must then draw them through small holes, to give them uniformity, and keep them in a receptacle which is filled with sulphur fumes. That is for the purpose of fumigating them. They are then ready for the instrument. I think the different sizes will give you a variety."

The directions were carried out, and during the following week the violin was prepared for its

initial test. The Professor was pleased with the knowledge that the instrument was ready. It was plain that he expected important results from that source with John. It is well known that music possesses a wonderful power in the treatment of demented people, and he was very anxious to try it in the case of one who had lost all memory.

On the evening appointed the violin was brought in, and the boys had arranged a program. Harry had a fine baritone voice, while George could take a high note and sustain it as well as most sopranos. When all the preliminaries had been arranged, the instrument was produced, and after a little preliminary tuning, George played "America."

At the first strains of the violin, Angel, who was in the loft, came down. He didn't stop to notice anyone but George. This was something so unheard of that he appeared to be hypnotized, as he shuffled over to George, and looked up at the instrument. He appeared to be entranced, and when the music stopped he laid his hand on George's knee, and looked up appealingly. There was not a single motion in his features which showed appreciation or pleasure or excitement; but aside from that every action of his body indicated exhilaration and undue animation.

The boys had eyes for the animal only; but the Professor watched John to the exclusion of everything else. When the first strains vibrated he glanced around, and saw the musician. From that moment until George dropped the violin his eyes never ceased the stare. As the music continued

he appeared to be enraptured, if such a thing could be said of a mute expression.

The Professor drew closer to him, and intently watched his eyes, and before the first verse had ended the situation was so intense that the Professor's hand involuntarily beat time, and it was evident that the tremulous motion, which John now and then exhibited, was the inward struggle for light.

Without turning from John, when the music ceased, he cried out to George, in a suppressed tone: "Keep on; keep on!" This brought the boys to the knowledge of the other drama which was being enacted. "Slower, George, slower," was the request of the Professor; and while "America" requires the jubilant strain of action and liberty, he obeyed the injunction.

"Keep it up; can you play 'Home, Sweet Home'?" George could, and did, and as the familiar strains floated through the air, John moved forward, his head drooped down, both hands grasped the chair and he listened with an intentness that was painful to witness.

When George stopped at the whispered suggestion, John raised his eyes and looked around. The look was a different one than they had ever noticed before. When he glanced at the Professor, Harry said: "Did you notice the difference in his eyes?"

He rubbed his hands over his eyes, and stroked his head, and they thought a glimmer of a smile crossed his features. When they were about to retire that night, the Professor could not help but

express his gratification at the results achieved through the aid of the violin.

"I could not help thinking how nearly allied Angel and John were in the manner of acting during the course of the music. I have no doubt but in course of time the animal will, just like John, show the facial expressions which characterize either pleasure or pain."

"But I have seen Angel actually laugh."

This was true; it had been noticed on several occasions. But so far John had not laughed, and he had not changed his facial expression in such a manner as to make it noticeable, and the evening's entertainment had done more to affect him than anything which had occurred, and it was their earnest hope that this might be a means to his delivery.

Harry was the only one to notice a field mouse which had appeared soon after George began to play, and the little animal was joined by others, but the subsequent events of the evening attracted his attention, so that no notice was taken of them until they were about to retire, when they scampered away and Harry then related how they had acted.

"That is an interesting thing. Some time ago the keeper of the Central Park Zoölogical Gardens, in New York, employed a violinist to play for the animals, and the results were very interesting. The first animals approached were a lioness and five cubs. The tune played was "America." She listened with mute and dignified appreciation, and her five little cubs ranged up alongside in a row,

and in the same attitude, all with a wondering expression, and sometimes would act just as you often have seen dogs do, turn their heads aside obliquely, as though the sound could be better understood. The old lion in the adjoining cage also stopped his restless movement, and peered at the player attentively. The next animal was a tigress.

Fig. 29.

THE LION AND CUBS

When the playing commenced she first looked startled. Her mate entered the cage and escorted her out into the yard while he took up his position and listened, and refused to allow her to return. The hippopotamus, on the other hand, got mad, and sought the water for seclusion. The elephant appeared to be the most discriminating, for while he deliberately turned his back when a plaintive

tune was played, was so delighted when a rattling dancing jig was executed, he actually danced about in ecstacies of joy. The wolves, foxes and hyenas could not be made to appreciate any of the tunes, but the monkeys enjoyed all the tunes, if being sad when doleful tunes are played give happiness, and they partook of the exhilaration when lively sounds came from the instrument."

The warm summer days were now at hand, and all realized that this was the proper time to carry out the long-delayed project of fully exploring the western shore of their little continent. This had been deferred before John came, in order that more complete preparations could be made, and to await settled weather, and now that he was here further delay had been urged in the hope that memory would be restored and thus give them an addition that could be depended on. One puzzling feature of his malady was that he understood, in a measure, what was told him, but it was noticed that whatever was spoken had to be accompanied by some manual action. If told to get a pail of water, he would remain inactive until a pail was taken up or pointed out. So in yoking up the yaks, merely pointing at the yokes would be sufficient to start the lagging memory. He quickly learned to manipulate the guns, and spent hours in practicing by shooting at the target.

Singular as it may seem, he showed some intelligence at the good shots, but all these flashes were momentary only, and it was further noticed that he would remember an act performed the day before and repeat it in precisely the same way. It

was like an imitative process, and the Professor suggested that he was now in the condition of a child, learning all things anew, to which was added some glimpses of things he had learned before.

A new wagon was necessary, as the one which had been used for the past eight months was clumsy and badly worn. All took a part in this important work, and it was here that the workmanlike qualities of John showed themselves. He was a treasure in this respect. The lathe was a pleasure to him, and so with bench work, and within ten days a new and larger wagon was turned out.

"I only wish," said Harry, "that we could paint it up, and thus make a real finished article out of it."

"Your idea is a good one, but in order to make a lead paint will take too long a time to provide a carbonate which will answer the purpose."

"Why does it take so long?"

"We have plenty of lead, but to get the base for the paint it will be necessary to cast a lot of thin gratings, and use earthen pots, partly filled with vinegar. A layer of the lead gratings must then be put down and the earthen pot stood on them and partly filled with acetic acid, or vinegar. A board should cover each pot and spent tannin bark placed around them. This must be built up in the form of a stack. Fermentation soon sets in, and the result will be the formation of carbonic acid, and in five or six weeks the metallic lead converted into what is called the carbonate which may be washed and ground up with oil, and sold as the white lead of commerce."

"Instead of that what should we use?"

"We have plenty of flax, as you know. From that we can make linseed oil, and with a proper coloring matter, which is not necessary, however, we can provide a paint that will be very serviceable."

"Then why not use the madder dye which we made for dyeing the flag?"

"Just the thing. In addition we must have a dryer of some kind. I suggest that we distil some of the rosin, or the sap from the pitch pine trees, for that purpose."

"What kind of product shall we obtain from that?"

"Turpentine."

Thus day after day passed in preparation, each hour, almost, suggesting some new addition to their stock, which would contribute to protection, comfort, or necessity. Among other things suggested, in order to relieve them as much as possible from carrying such a large burden in the way of provisions, was the making of synthetic foods.

George had this in mind for some days before he broached the subject to the Professor. "I understood you to say that if we had synthetic foods we could carry several weeks' rations about our persons, and the load would not be a heavy or perceptible one at that? If such is the case, why can't we prepare some of the food in that way as a matter of precaution? What is the meaning of the word 'synthetic,' and how is such food made?"

"The word is the direct opposite of 'analyses.' In analyzing, the elements composing any sub-

stance are separated from each other. In synthesis the different elements are put together to form the substance. Thus, take water as an illustration: Its component parts are two parts of hydrogen and one of oxygen. Knowing this to be the case, the chemist takes that many parts of oxygen and hydrogen, and by uniting them water is formed which is just as much a true water as though it fell from the heavens or was taken from a well or spring."

We should not go far out of the way in stating that the Professor was putting in some time in this direction, while the other work was going on, and this was confirmed later on when he requested Harry to furnish a number of small tubes like those used for the powder, and it was noticed that a quantity of bamboo was taken to the laboratory and cut up into short sections.

The guns and ammunition were now ready, a supply of food had been prepared, and George insisted on baking a quantity of barley bread, which was carefully wrapped up, so that it would not be dried out or be liable to get wet. The wagon was admirably adapted for the purpose. The wheels were not extraordinarily large, but they had wide treads, and the body was high at the sides so as to serve as a fortress in case of trouble. An extra yoke was taken, a supply of sugar and also of honey put in the vessels which the cave supplied, and only a small store of vegetables, as they depended on finding these en route.

The start was agreed upon for the following morning. Observation Hill was visited, and a new

inscription affixed to the pole, so that any passing ship might know their plight, and be able to direct its course to the west. The value of the chart made by the Professor was now appreciated, as that was also tacked up in its proper place.

Jack and Jill were the yaks selected for the journey, as they were tried and true, and had now grown to be strong and well domesticated. Freedom was given to the cattle, and all the buildings closed up. This was done to secure the interiors from intrusion on the part of animals. An inscription was also placed on the door of the house.

Promptly at nine o'clock the company, consisting of the Professor, Harry, George, John and Angel, started on the journey across Wonder Island. This was their sixth trip, only one of them by sea.

Would this be any more successful than the preceding ones?

CHAPTER XVII

THE TRIP THROUGH THE DENSE FOREST

On the march up Cataract River, and out toward the forest, the same order was observed as on the previous trips. One must lead the way, and act as scout, while the others were to remain with the team. They did not anticipate much difficulty during the first two or three days from savages, but it was always well to have some one in the lead so as to point out the most desirable paths, as it must be remembered they had to make their own trails through a wilderness. Much of it had been traveled, it is true, but there was nothing approaching such a thing as a road, or even a path, by which they could be guided.

It was amusing to watch Angel, as he glided along from one tree to the next, where the forests were in their paths. At other times he would be in the wagon, or shamble along, and sometimes leap on the backs of the yaks and ride there. The patient animals were so used to him that no attention was paid to his antics, even though he occasionally sat on the yoke between the animals.

John was an interested observer of all the preparations, and was one of the first to take his place alongside of the wagon. When the Professor urged him to take a seat he looked up inquiringly, but did not comply. The Professor did not urge him, but after several hours of walking, he was

again asked to mount, and he did so, thereby seeming to understand what was required of him.

When they camped at noon for the first meal, they were still on the banks of the Cataract, but here it took a decided turn to the west; and now the course for the afternoon must be to the southwest so the South River could be reached above the falls.

That river was reached early in the afternoon, and they recognized the trail formerly made on the first journey along its banks. The first encampment for the night was probably twenty miles from home, but the next morning, after they had struck into an entirely new section of the island, the journey grew more burdensome, as the land on both sides of the stream became rough, and in many places the small streams crossed offered such steep sides that frequent detours had to be made to enable the team to get across.

During the second day they did not, on account of this, cover more than ten miles, and near the close of the day a second falls was reached, showing that they were going up to a much higher altitude. Above the falls the river turned abruptly to the south, and within five miles of it the river forked, one branch going south and the other southwest.

They were on the branch going west, and that course was followed, but still the country was rough, and now became thickly wooded, which added to the discomfort of traveling with a team. Magnificent trees grew on every side, and in most places sprang up clear to the water's edge.

"You have here a good illustration," remarked the Professor, "as to the source of the debris which is found on the shores of the island. The streams carry down the logs, trees and leaves, which, after being washed out to sea, are finally left along the beaches."

Our voyagers had passed many nights in the forests before, but this was the first time they had come across such impenetrable jungles. The large trees were actually so close together at many places that the wagon had to be backed and worked around for long distances to enable them to make any forward movements.

Before noon of the third day it became so discouraging that they stopped to consider the situation. Possibly a route away from the river would be much better, and that course was decided on, so that the direction agreed on was west, with a slight trend to the north.

The reason why the course along the river would be the most direct was judged from the fact that the lights, which they saw from their boat, made the location of the savages fully fifty miles or over from the northernmost cape where they had been cast ashore a few weeks before.

The travel must, therefore, be to the southwest, and not to the west, but at the rate they were going, with every hour more difficult, it was hoped that the new course would in the end be quicker. All of that day the struggle was a strenuous one, and when night came all were exhausted, and were ready to retire as soon as the meal was over.

They were in the midst of the thickest forest,

and up to this time all had retired, as they did on this occasion. The yaks were enclosed in a railing made of small trees, so as to protect them, and the two mattresses within the covered body made comfortable beds for all.

Strange sounds occasionally disturbed them, but caused no particular alarm, until Angel began to grow restless, about two in the morning. George tried to quiet him, but he persisted in giving the alarm. Suddenly a howl and a shriek awoke the occupants of the wagon and as each arose he instinctively grasped a weapon. The sounds came from two animals, one of which was close by; the other at a greater distance.

"The one near us seems to be a wildcat, or an animal which utters a characteristic shriek of that kind, but I am not sure as to the identity of the other animal," remarked the Professor, as he listened intently to the hideous howls and shrieks.

It was pitch dark, so that it was impossible to recognize anything in the wagon, and of course the dense forests only added to the gloom, although the sky could be faintly seen directly above them through the scraggly leaves. The Professor searched for one of the lanterns, when he heard the yaks becoming uneasy, and running back and forth in the little enclosure.

John was awake, and his eyes seemed to have a sort of glimmer as the light flared up. The rear end of the wagon led directly into the pen where the animals were, and no sooner had the light rays illuminated the enclosure than a heavy object

sprang from an adjoining tree and landed on one of the yaks.

The latter was thrown across the pen with the impact of the force, and the Professor, who had the lamp, could not level his gun, but without a moment's hesitation John's gun was at his shoulder, and he fired before either of the boys could recover themselves in the excitement.

The firing of the gun seemed to raise pandemonium. The sudden appearance of the light, as the animal made the leap, disconcerted him, and the shot following immediately, caused him to utter a terrific growl. John grasped the Professor's gun and shot the second time, and the shot was at blank range. The animal gave a slight spring forward, and fell across a tree trunk which was at one side of the enclosure, and on which they had arranged the cooking utensils the night before.

This was exciting enough for one night's adventure, but as John and the boys were about to descend a crash in the trees to the right caused them to halt. The Professor held out his light, but the thick wood and the dense underbrush prevented any examination more than thirty or forty feet beyond.

The eagerness of the boys to return to the wagon caused the Professor to loose his grip on the lamp, and before he could recover the hold, it fell to the ground and was extinguished. The yaks appeared to be in a frenzy now, and the howling beyond increased in intensity. After a search the lamp was relit, and the two others also brought out and lighted, and the appearance of

the light caused a hurried retreat of the howling beasts.

"It is a puma," were the Professor's first words, 'the most enormous specimen I ever saw."

"Well, these woods must be full of them, by the way they howled."

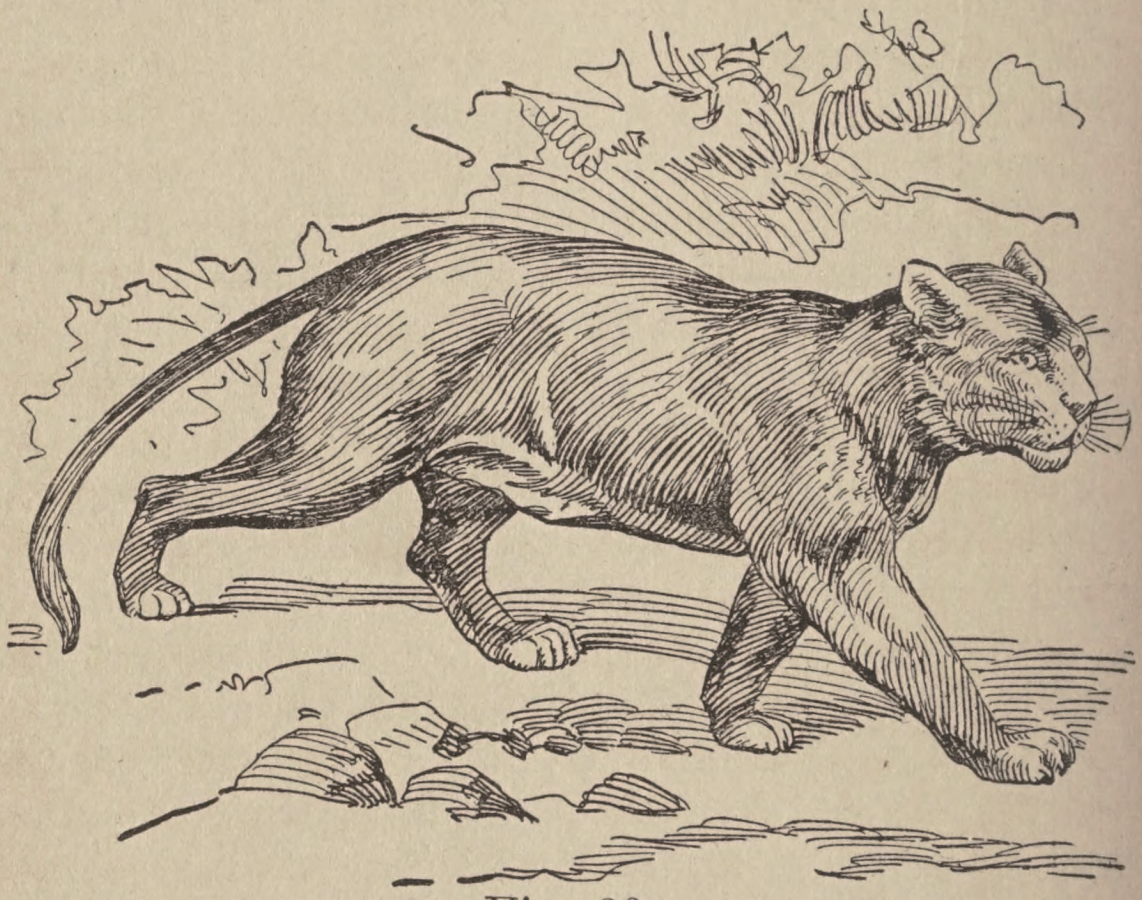


Fig. 30

PUMA

The yaks were calmed down after some effort, and it was found that the shoulder of Jack had been lacerated by the claws of the puma, but beyond that no damage was done. Both of John's shots had taken effect, and it delighted the Professor to point to the wound and then indicate, as best he could, how they owed him a debt for his skill.

The carcass was dragged out of the enclosure to keep the yaks quiet, and when this was done they seemed relieved.

"I would like to know what the other animal was?"

"It is my opinion that it was a companion to this one. They, like all animals, have a means for communicating their ideas to each other. Some English scientists have found that the hen utters twenty-three distinct notes, and that they convey different meanings. One single note, differing from another, may convey the meaning of an entire sentence uttered by man. The particular purring of a cat in one way means one thing, and when emitted in a slightly altered tone indicates something entirely different. Then, again, most animal sounds are accompanied by some distinctive movement, as, for instance, the striking squeal of a hen, accompanied by the crouching attitude, together indicate the appearance of a hawk as plainly as though it uttered the warning in words. It is obvious, therefore, that all the sounds made by animals, such as cackling, clucking, crooning, purring, crowing, growling, and roaring, as well as modifications of these sounds, impart some meaning which can be distinguished by their kind, and are frequently recognized by others."

This explanation appealed to George. "I know the moment Angel is pleased, or when he is excited, and now that I think of it, I am sure that he has several ways of expressing his meaning,

and I am going to try and see whether I can tell the difference hereafter when he tries to talk."

There was little sleep that night, except on the part of John, who was soon asleep. When morning broke they had an opportunity to examine the dead animal. It had a uniform gray color, fading into a white in the under part of its body, and with a very long, supple tail.

"The animal is sometimes called the panther, or 'painter,' as it is familiarly known; and it is regarded by some authorities as the cougar. It inhabits the whole of America. Its home is among the branches of trees, and is a dangerous antagonist when wounded or cornered."

This incident made them desirous of quitting the forest by the nearest route, but this was difficult to determine, as there were no elevated hills in sight. In the forenoon of the third day, other animals were sighted, and George, who was in the lead during the first part of the trip, did not have the courage to go ahead very far, and soon after the start was made, John came up and accompanied him, an act entirely voluntary on his part, which increased the astonishment of them all.

It is impossible to account for these remarkable actions of the human mind while in such a state. Did he realize the danger to his friends? Who can answer the riddle?

But they must go on. The forest must be conquered. How far they had to go was a mystery to them. One thing was certain: they were going toward West River, but they were still less than half way. It would have been the part of pru-

dence to have taken the route to the north, through a country which they had twice traversed, and which afforded far better traveling, but it could not be helped now.

The fourth day did not improve their condition in the least. The dense wood was on every side. The inclination of the ground was so slight as to give no indication whether they had reached the summit of the tableland, or were still ascending to a higher level.

In estimating the distance traveled in the four days it could not be possible that they were over fifty miles from the Cataract. To add to their perplexities, Jack began to walk with a perceptible limp. The wound in the shoulder was inflamed, and a rest was necessary.

In this emergency a council was called, and the Professor suggested that some of the party should conduct an exploring expedition on foot to the west, going not to exceed five miles, and then return. But as it was too near night to make the attempt at once, it was agreed that an early start should be made in the morning.

The question now arose, who should go. Neither made a suggestion until Harry ventured this opinion: "I am perfectly willing to take John with me. I am sure he can be trusted. It will be imposing too much of a burden on you," said he, looking at the Professor, "and I am active and strong enough to stand the trip."

This suggestion was acted on, and early in the morning Harry took a quantity of ammunition, and the Professor gave John a similar supply

and a couple of the guns, one of which was strapped to his back, similar to the manner in which Harry was equipped. The attention of John was then directed to the forest in the west, and as Harry moved away he followed with a comprehensive glance that gave all of them the greatest relief. Prior to their departure, the yak's wound was examined, and John saw this as well, so that from all indications they would have no reason to have fears on his account.

As usual, their bolos were taken along, and at intervals the trees were blazed on both sides, this action being performed by John with a regularity and precision that astonished Harry.

Traveling under those conditions was not conducive to speed, but they were now trying to find what lay beyond them, and to learn, if possible, how much farther the dense growth existed beyond them. They went on for three hours or more, and still no change, and they stopped to rest.

Imagine yourself surrounded by these conditions. A companion who could not talk, and who was, in all probability, demented, the eternal silence, except as it would be occasionally startled into life by some living thing; unable to even indicate his thoughts, or to consult with him, as to direction, or to talk about the probabilities beyond them, and you will feel that it took a brave heart to continue the journey. But Harry possessed determination. He made up his mind to go on, until he could find some news to take back, and so the quest continued for two hours more.

But Harry had forgotten that they started without food, and that it would take them as long to get back as they had already journeyed, and it was now fully noon.

It seemed as though a hundred feet away it appeared clearer, but this delusion had been repeated so often that he tired of it, and when, after a rest, another start was made, he mentally made up his mind that if he could not find a clearing within the next half hour they must return.

The clearing beyond did not deceive him this time. He clearly saw an elevation beyond, and he almost shouted, but he did not stop and laugh in his joy at the sight. John saw it and instinctively knew its meaning. Then, motioning to him, he pointed back in the direction of the wagon, and started to retrace his steps.

It was past noon, and Harry was hungry. John turned and followed and, glancing at the sun, drew a small package from his coat, and handed Harry several slices of barley bread. It affected him so much that he could scarcely contain himself, and he could not help putting his arm about him and indicate that his forethought and kind act was appreciated, and John looked at Harry inquiringly, and proceeded to eat his luncheon.

Judging the time which had elapsed since the start in the morning, it would take them fully five hours to retrace their steps, as the glazed trees showed them the way readily, and they could, therefore, make the trip in less than six hours consumed up to this time, so that they would be

back before six in the evening, but they had found the outlet, and determination had won.

The passage back through the forest was made with a happy heart, and after they had gone two hours, John suddenly stopped, and grasped Harry by the arm as he peered forward. Harry heard something before them. Crackling leaves, and finally voices, were distinguished. They thought the team must be miles away. John moved forward fully fifty feet, and Harry followed. Soon the wagon top came in sight, and Harry bounded along the blazed trail, with a cry of relief.

Jack's lacerated shoulder was not as bad as had been anticipated, and toward noon the lameness was not so perceptible, so that, in order to save time, it was concluded to follow the blazed path, which could be made out easily, thus bringing them together fully three hours earlier than Harry had anticipated.

Harry explained what had been seen to the west, and that three or four hours more of hard travel would bring them to an open country which, in all probability, led to the West River.

All was eagerness now, and they pressed forward, hoping to be able to reach the open country before night set in.

CHAPTER XVIII

SEEING THE FIRST SAVAGES

GEORGE'S patience in teaching Angel was most commendable. Hours were devoted to this work. Even before leaving home the animal would recognize certain sounds, and performed many acts at the word of command. Such words as "come," "go," "take this," and others usually employed, were fully comprehended, and the names of Harry and the Professor were understood.

Frequent tests were made by George and the Professor, acting in concert, as this phase of the education greatly interested the latter, to ascertain whether the orang performed the services from an understanding of the meaning of the words, or whether it proceeded merely from the constant repetitions of the words and acts conjointly.

The value of this proceeding will be made apparent to the reader as we proceed in this history; but when they were educating Angel the idea of utilizing his future services, in a critical time, did not occur to them.

They camped for the night at the end of the trail; and now they hoped that the morrow would open the route over a more comfortable path than the last three days had offered them. Before going an hour on the way, a campfire was found,

which evidently had been used not many days before.

There had not been any rains in their section of the country for ten days previous to this, and it was obvious that no rain had fallen on the ashes of this fire. From this it must be inferred that whoever made the fire must have been there recently.

The utmost vigilance would be necessary, in view of this discovery. The wagon moved forward slowly. Every part of the country within the limits of the trail was under scrutiny, and every sound and moving object fully investigated before proceeding. This made travel necessarily slow. The underbrush was very thick, and but few trees remained, and those were scattered, mostly in clumps or in detached groups.

Harry looked at the tall trees longingly many times, and the Professor divined his meaning. "I have a notion to try prospecting from one of these trees. We can, no doubt, see more from them than we can learn in a day's travel. But trees of that kind are pretty hard to climb."

"It might be done with a climbing ring," answered the Professor.

"What is that?"

"The cocoanut hunters and others put a hoop around a tree, and then get inside of the hoop, with the back against the hoop, so that the feet can get a purchase against the tree, and in that way the trees are scaled with the greatest agility."

"Well, if the savages can do it, I can."

"With a single stroke the body of the snake was severed above the last coil"

[See p. 218]

"It might be well to make the trial, as even thirty or forty feet would give a fair view of the country. Before making the hoop we should select a tree most suitable for observation."

An oak tree with a bare trunk up to the first large limb was finally selected. The diameter was fully two feet at the base.

"With a tree of this size the hoop should be about three and a half feet in diameter."

"What material shall we make it out of?"

"If we can find a small hickory sapling it will be the most serviceable, because its natural strength and stiffness will permit us to use a small and light pole."

A search was made, and after a time several were cut and brought to the tree. The thick end of the sapling was cut or pared off along one side so it would bend in the direction of the slice, and this was put about the tree and the ends brought together and lapped. Thongs were then used to splice the lapped ends, and small nails driven in at intervals to assure security.

The use of hoops of this kind requires practice, and the natives use their bare feet against the tree, which prevents slipping. Harry, however, had shoes; not a very good thing to use against the bark, and after numerous trials both boys found the task a trying one. Their bare feet were too tender to use against the rough bark, and as a last resort one of the old pair of shoes was brought out, and studded with nails.

The climber gets inside the hoop, with the lat-

ter around the tree, and resting against the small of the back, or a little higher up. The feet are then braced against the tree, and the hoop grasped by both hands. In climbing the body is suddenly moved toward the tree, and this motion temporarily releases the outward pressure against the hoop, and at the same moment the hoop is moved upwardly about a foot. One or both feet then make an upward step, and this process is repeated.

More than an hour was occupied in learning to manipulate the hoop, so as to progress upwardly, and at the end of that time Harry made a slow and careful ascent to the first limb, a distance of thirty feet, stopping at intervals, as he made his way up, to view the ever-increasing landscape, and to take the needed rest.

"Do you see anything, Harry?" was George's eager questioning, as he moved upwardly.

"Nothing yet," was the invariable reply. When the first limb was reached he seated himself, and had an opportunity to view the surroundings from a far better vantage point.

"Can you see the river?" was the Professor's inquiry.

"It is too hazy to make out anything there. It is clearer to the south."

"What can you see to the southwest?"

Harry scanned the country in that direction for some time before replying. "All I can see there are trees, trees, just like the forest we have been going through; but directly west of us we would have comparatively easy traveling. The forest

seems to extend southwest, and we have been traveling through it at an angle. If I could get higher I might have a better view."

He ascended fifteen feet higher, but even at that point the forest hid the view to the southwest.

"From your examination I judge our only hope is to reach the river and travel down its banks?"

"Yes; because we don't want any more of the forest with the team."

"Before we go, let us take off the hoop; I want to use it again." And Harry unwrapped the thongs and disengaged it from the tree.

After luncheon the marching was resumed, this time due west to the river. The trip during the day told on Jack, and a halt was called before they had gone five miles. Harry and John took their guns and started south on a tour of investigation, making their way toward a slight elevation which he had noticed from the observation point.

It was really a hill, covered with trees, and gave the appearance, from the tree top, as being a continuation of the forest range. This was good news to carry back. While passing through the tallest of the trees, Harry, who was ahead, felt himself suddenly grasped, and he uttered a scream.

John rushed forward just as Harry saw the repulsive form of a huge snake which had wound itself around him. Harry was absolutely helpless in the folds of the serpent. John's quick eye took in the situation at once, and by the time he reached Harry the bolo was in his hand and poised. With

a single stroke the body of the snake was severed above the last coil, and the portion suspended from the tree fell alongside of the combatants, and John's hands reached out to assist Harry.

Harry was frightened so that he could hardly utter a word, and after some exertion he disentangled himself and gazed on the immense serpent. When he had recovered partially he was too much excited to proceed, and they returned to the camp with a story of the attack and the noble rescue on the part of John.

George's excitement was at fever heat. "We must get his skin." Harry was willing, because a trophy of that kind was worth preserving. The team was taken along, as it was fully a half mile from the camp. When the Professor saw the serpent he congratulated Harry on his escape, who, but for the fortunate presence of John, would have been killed.

It measured twenty-two feet in length and its greatest diameter was eight inches.

"What is this—the boa constrictor?"

"It belongs to the same family, but is known as the anaconda."

"What is the difference between the boa constrictor and the python?"

"The boas are the species found in the western hemisphere, whereas the pythons inhabit the eastern countries. The anaconda is a native of Brazil and some of the other South American countries. They are non-poisonous, and depend for securing prey on their wonderful swiftness and in

the tremendous power which they exert when the victims are in their grasp."

As usual, George had been prospecting also, and when the skin had been removed and the excitement died away, he exhibited a peculiar fruit. It was the shape and size of a pear, but had a peculiar kidney-shaped pendant at its large end.

Fig. 31. Acajou.

The Professor smiled when he saw it. "You have the fruit of the Anacardium, or cashew tree. That is, it is a combined fruit and nut."

"Is this little projecting part a nut?"

"Yes; and this evening we can try some of them; but they must be roasted. The fruit can be eaten as it is, but it is like the persimmon; it must be fully ripe, or it will be too astringent. It is a fine medicine, and the sap of the tree produces a product like gum arabic, and is known in commerce as acajou."

The elevation which Harry was anxious to gain

was before them, less than a mile, and as it was not more than four in the afternoon, the team was driven forward and the slight ascent begun. In a half hour the summit was reached. It was not at a great elevation, but the incline was a gradual one, and it was hoped that from the elevated portion a better glimpse could be obtained than the tree afforded.

It was too late when they reached the camping place to attempt any observations that night, but in the morning an investigation was made to find a tree of sufficient size to afford a good view. When it was finally found the hoop was again brought out and Harry slowly made his way upwardly, and those below waited in suspense for news.

He made a deliberate survey, and called down: "I can see the West River, and directly to the southwest are white objects, but so far away that I cannot tell what they are. They may be tents or huts, or something of that kind. I couldn't say positively."

"Do the objects appear to be at or near the river?" asked the Professor.

"It is difficult to say whether the river goes in that direction. I can see glimpses of the stream only here and there."

"Do you see any mountains to the south?"

"None whatever. Everything merges into a haze beyond the white objects I referred to."

"It is probable," said the Professor, "we have located them, as I find, from an examination of

the sailing chart, that the village is located at about that point. I think our course should now be directed to the river, as traveling will be better near its shores, and we would, I think, be more likely to meet some of the inhabitants along the shore than in the dense interior."

The low mountain range beyond the West River was plainly visible from the elevation. The Professor noted how its lower end sloped down, and he knew their location beyond question, and explained that they were now practically due east of the point where they were compelled, on the tempestuous night, to turn back to the north.

It was a long, weary night for them, because expectation ran high. They were anxious, and yet dreaded the meeting, but they had sought it and could not go back now. No fires were kindled that night, although George had counted on some of the roast nuts. It would not be safe to hazard a light.

The utmost vigilance was now to be the watchword. There must be no firing of guns or wandering from the camp on the part of either. At the time the wagon was constructed the Professor had an eye to its use as a means of defense, which was explained to the boys, and this offered a great sense of security to them.

The sides had been made high with this end in view, and not for the purpose of hauling big loads. If attacked in the open, it would serve as a fort, and would enable them to move around from one side, or end, to the other without being exposed. In anticipation all the guns were examined and

the ammunition placed within reach and conveniently arranged for any emergency.

The provisions were also arranged to prepare for a siege if necessary. During that evening the Professor for the first time explained in detail how the natives would be approached.

"I think it is well, now that we are about to come in contact with the people here, to be prepared to meet them in the proper way, so as to insure safety to ourselves. It is likely that we shall have to treat with the natives, and thus come to some understanding, before we entrust ourselves to their mercy. Above all things, we want to impress on them the feeling that we are not antagonistic and have no hostile intentions. We are unfortunate in not knowing the character of the dwellers on the island. They may have had frequent contact with the outside world. That may, or it may not, mitigate our lot. So we cannot count on that factor too much. If they are low down in the scale of humanity, we may find a still harder problem. In any event, however, this must be made plain. The wagon is our fort. From that we can defy them, unless they have firearms.

"From this time on let us keep together——"

Something unusual stirred beyond. The crackling of twigs was plainly recognized, and the mumbling sound of voices could be made out. They were human voices, but their intonations, as they came nearer, were sufficient to show that the language was not that of civilized people. They

were more in the nature of successive grunts, not much more definable than the noises of animals.

They were wrought up to the highest tension, and the only fear was that either Angel or the yaks would make some noise which might attract the passers-by. To their great relief the sounds died away. This visit would have been welcomed during the daytime, but at night they could not afford to take any risks.

This incident showed they were now in an enemy's country. The river was fully ten miles to the west of them. How far the encampment or village of the inhabitants was to the south they could only imperfectly estimate, but it was certainly twenty miles or more.

What they longed for at this stage more than anything else was the open country. The proximity of the river would likely be the better place for them, so early the next morning the team was gotten ready, and before starting, the Professor made a survey of the surroundings in the direction that their visitors had gone.

At several places were indications of tracks, and these were followed, the team coming along behind. Everything was covered with leaves where the trees abounded, and in the more open areas the grass was so well advanced that it was difficult to distinguish tracks in the earth, but the broken-down grass plainly showed their trail, leading to the south.

Aside from that, nothing could be gathered to give any indications until they had proceeded over

a mile, when a small rivulet, the first they had noticed since leaving West River, crossed their route. The Professor actually bounded forward at the sight and examined the footprints. The marks of bare feet were visible where they crossed, and they were of abnormal size.

After a careful examination, the Professor said: "There must have been at least a half dozen of them, judging by the different prints. See, this one has a deformed foot, or the big toe is missing; and this one must be a large man, judging from the deep impression made." Beyond the vicinity of the stream all footprints were again lost.

"As we are now likely to have an open country until we reach the river, we can make more extended observations from the top of the wagon, and one should be there constantly to notice any signs on either side."

They were within five miles of the river, and George, who occupied the post of lookout on the top bow of the wagon, called out excitedly: "I can see them; there must be a dozen or more." The wagon stopped, and the Professor and Harry hurriedly scrambled to the top. John saw the movement and seemed to understand, for he also crawled up and looked across the rolling landscape to the southwest.

In the distance were unmistakable movements of beings moving to and fro. They were distant at least two miles, and there was no evidence, from the character of their movements, that anything unusual had occurred, and it might there-

fore be inferred that the wagon had not yet been discovered.

At last they had come up to the people who occupied such a large share of their speculations during the past year, and in "The Tribesmen" are set forth the meeting of the savages and the hostile manner in which they were received, together with some of the things which really show why the land they lived in might justly be called "Wonder Island."

THE END

GLOSSARY OF WORDS

USED IN THE TEXT

Alloy. A combination of two or more metals.

Actinic. Photographic rays. Those vibrations above the vibrations which produce violet.

Acutely. To the point. Being keen.

Allied. Attached to; bound to; an arrangement with.

Alienation. To cause to turn away; to make indifferent.

Amplitude. Scope; reach; breadth; fullness.

Antiquated. Adapted to the uses or customs of olden times.

Animation. Possessing animal life; sparkling; lively.

Antagonistic. Against; opposed.

Agility. Quick; sprightly.

Assumption. Taking it for granted.

Bacteria. A microscopic microbe, very minute, widely distributed in all matter.

Betokened. To give promise or evidence of; presage; indicate.

Bestowed. To confer as a gift; to give freely as a gift.

Buccaneer. A pirate or freebooter.

Bullion. Gold or silver in mass, usually in convenient bar.

Calcareous. Impregnated with lime, or largely composed of it.

Cardinal. Of prime or special importance.

Caulking. The process of filling the seams of vessels.

Cavities. Holes; depressed portions.

Carbonate. To impregnate or charge with carbonic acid.

Calcium. Lime.

Canopied. A covering. Usually a conical top.

Centrifugal. Directed or tending away from the center.

Characterize. To delineate or set forth in a particular way.

Consistently. Standing together or in agreement.

Convolute. Rolled one part on another or inward from one side.

Coefficient. A number or letter put before an algebraic expression, to show that one is to be divided by the other.

Constant. That which is permanent or invariable.

Convex. Bulging outwardly; raised.

Conducive. Helping; tending toward.

Contingency. The awaiting of an event; in the event of.

Compounding. Made up of two or more substances.

Contracted. Made smaller; reduced in size.

Combustion. Being consumed. Disintegration.

Contemplated. To consider thoughtfully; to look at attentively.

Caucasian. Of, pertaining to, or characteristic of the white race of mankind.

Consistency. Harmonious; not contradictory.

Clarified. Made clear; not turbid or cloudy.

Crucial. Decisive as between views or theories. Testing.

Cylindrical. A barrel-shaped body.

Decoration. To adorn with something ornamental.

Debris. Accumulation of material.

Defect. Something short; not perfect.

Density. Closeness of parts.

Delver. One who searches into things.

Demeanor. Appearance; manner; action.

Domesticated. To bring under the control of man.

Delusion. The state of being deceived or led astray.

Dilapidated. Torn up; fallen into decay; gone to ruin.

Discrimination. Ability to select; to judge; to be able to pick out.

Deranged. A disordered mind.

Deportment. Manner of acting.

Dextrous. Skilful; quick; adroit.

Designations. A distinctive mark or appellation.

Depressed. Lowered; made unhappy or unspirited.

Determination. Insistence; firmness; fixed purpose.

Decomposition. The act or process of separating anything.

Dimensions. The measurements; sizes.

Dilemma. A perplexing case to decide.

Duplicated. Made in a similar manner.

Duct. An opening, hole, or conveyor.

Ductility. Capable of being drawn out.

Effective. Fit for a destined purpose; a striking impression.

Emergency. An unexpected happening calling for immediate action.

Emaciated. Greatly reduced in flesh.

Entranced. To put into a state of ecstacy.

Ensue. That which follows; to go after.

Enraptured. Overpowered with emotion.

Entablature. The uppermost member held in place by columns.

Episode. A particular occurrence.

Essential. The particular thing; the important element.

Estuary. The portion at the mouth of a river where it discharges into another body of water.

Exhilaration. Lively, pleasing or enlivening sensation.

Extracted. To take from. Taken out of.

Facial. Pertaining to the face.

Facility. Doing with ease.

Fascination. A resistible influence. A pleasing impulse.

Fathom. To find out; depth; penetration.

Fermentation. A chemical condition where germs are developed and grow in a substance and change the elements comprising it.

Feasible. Easy to accomplish; that which is practical.

Fiber. A structure composed of filaments, like a vegetable stalk.

Formation. The manner in which articles or substances are built up.

Fracture. A break or crack.

Fraternity. A body of persons held together by some common tie.

Fusing. To melt by heat.

Fumigating. To treat by means of gases.

Fulcrum. The support against which a lever rests.

Granulating. To form into small grains or particles.

Grotto. A small cavern or cavern-like apartment.

Gruesome. Suggesting gloomy or frightful thoughts.

Gunwale. The upper portion of the hull of a ship or boat.

Horizontal. At right angles to a line directed to the center of the earth.

Hypnotized. A treatment which acts directly on the mind or nervous system.

Impervious. Permitting no passage through or into.

Immoderately. More than the usual; more than the ordinary.

Instructively. Along educational lines; learning things.

Intonation. The modulation of the voice.

Inactive. Not vigorous.

Intestines. That part of the digestive tube below the stomach.

Intimation. A hint.

Intruder. To enter or appear when not wanted.

Inscription. A writing; an announcement.

Inevitable. Anything which is bound to happen. A result.

Insulated. Shielded from something.

Interim. In the meantime. Within certain periods.

Incidence. Happening at the same time. A circumstance.

Interpret. To make plain. To bring to an understanding.

Ingenuity. To devise; to bring forward out of the ordinary.

Inordinately. More than the ordinary course or manner.

Indicate. To show, or to point out.

Intensity. With full vigor; strong; vivacious.

Inverted. Upside down. Turned about.

Insistent. To continue urging; determination.

Involuntary. Without intent; in spite of all precaution.

Inefficient. Not careful or prudent; without full capacity.

Jubilant. Joyous.

Laboriously. Consistently carrying out work without regard to the amount of labor required.

Lacerated. To injure or to tear the flesh.

Lee. The side or direction opposite to that from which the wind comes.

Malady. Sickness. Particular kind of illness.

Manipulate. The manner of handling. To artfully influence the result.

Manifestation. Made known; acknowledged; understood.

Maneuvered. To make methodical change of position.

Maritime. Pertaining to the sea, or to naval affairs.

Mercury. A silver-white metallic metal in a liquid state.

Minimizing. The smallest state. In the least difficult position.

Misgiving. A feeling of doubt or apprehension.

Miniature. Small; a little copy.

Momentum. The power of overcoming resistance possessed by a body.

Mobility. The capacity to change or alter.

Monopoly. Possessed of complete power. Full sway.

Nitrogenous. Partaking of the qualities of nitrogen.

Normal. A perpendicular; according to an established law or principle.

Obliquely. A deviation from the direct line.

Octagonal. Eight-sided.

Orbit. The course in which a planet travels.

Orifice. A hole; an opening.

Orgy. Wild or wanton revelry.

Ozone. An allotropic condition of oxygen. A substance made from oxygen.

Pandemonium. A fiendish or riotous uproar.

Paleontologist. A student in the origin of life on the globe.

Patriarch. The elder; the one in a tribe on whom authority vests.

Pathetically. In a vein of sadness; arousing tender emotions.

Parallel. On a line with; side by side the same distance.

Paralyzed. Loss of power to control the muscles or other parts of the body.

Penetrate. To go into.

Perforation. To make an opening or hole.

Periodical. At regular intervals.

Peaty. Having the characteristics of peat.

Personified. To transform from a thought or speech into a person.

Perturbed. To be disturbed in mind.

Perceptible. Noticeable; seen.

Phenomena. Something directly observable; anything visible.

Primitive. The first way of doing things; the original plan or method.

Prospecting. Investigating; trying to discover new elements or substances.

Profusion. Many; an abundance.

Port. A haven. The left side of a vessel.

Proportionally. Relative magnitude, number or degree.

Predominating. Overshadowing; possessing power.

Properties. The elementary substances of any material.

Propagate. To bring to a better condition or state. Making an improved breed or type of animals or plants.

Prognosticate. To foretell.

Promulgate. To announce; to give out.

Privation. Hardship. To be kept from the necessaries of life.

Promontory. A high point of land extending out into the sea.

Progenitor. An ancestor in the direct line.

Proximity. Close to; in the neighborhood of.

Radiating. To emit or send out rays.

Relaxation. A change from the ordinary routine.

Retarding. Holding back; making the object go slower.

Reticent. Habitually keeping quiet or in reserve.

Regulation. In accordance with some law or order established.

Refraction. That property in light which causes a bend as the ray passes from one substance through another.

Reverse. In the opposite direction.

Rifling. Spiral grooves in the bore of a gun.

Rotation. Turning; moving around a common center.

Seepage. Leaking; passing through.

Sequence. That which follows as the result of a certain thing.

Secluded. Kept hidden; not exposed.

Spherical. Round like a globe.

Spiral. Having the twist of a corkscrew.

Spawning. The period when fish lay their eggs.

Stringers. The longitudinal pieces which form the main frame of a structure.

Standard. A post. Also the flag or ensign of a country.

Strata. Parts of layers of earth, rock, or other material.

Strenuous. Vigorous; insistent.

Suppressing. Trying to keep out of sight; hidden.

Substitute. In place of.

Sulphide. A compound of sulphur with another element.

Subsided. To stop; to proceed no further.

Symptoms. Indications; showing effects of certain illness or treatment.

Synthesis. The putting of different things together.

Theorist. One who speculates; one who tries to arrange facts to harmonize.

Timbre. The peculiarity of a sound whereby it is distinguished from another.

Tortuous. Moving in a winding or irregular way.

Tourmaline. One of the gems, found in various colors.

Traverse. Across; traveling; to go over.

Triangulation. The method of surveying whereby two known points are used to find a third, by means of the angles made.

Utilitarian. One who tries to take advantage of any knowledge and make use of it.

Untenable. Without good ground.

Vacuum. A space entirely devoid of matter.

Veered. Turned aside or in a different direction.

Veritable. Truthful; well known to be correct.

Vibration. Any movement which is more or less irregular and continuous.

Vividly. Distinctly seen; brightly appearing.

Wrench. To twist violently. To injure by a forcible turn or movement.

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